Factors Affecting Science Instructors', Science Undergraduate Students', and Non-Science Undergraduate Students' Perceptions of Bioethical Decision-Making

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A Mixed Methods Project Submitted for the Master of Arts Degree in Science Education at the University of North Carolina at Pembroke

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Abstract

Bioethics is important for a variety of fields and for a variety of reasons. There is renewed interest in bioethics and bioethical decision-making, especially in bioscience with the advent of new discoveries such as genetic engineering. By examining the possible factors and the participants' reasoning behind their ethical decisions, bioethics educational courses or training can be customized to fill in knowledge gaps of both students and professors. This knowledge will also provide a more well-rounded thought process that includes understanding other viewpoints when making important bioethical decisions. The purpose of this study was to examine the factors and ethical approaches that affect bioethical decision-making in undergraduate students and science professors (physics, geology, geography, biology, chemistry) at a regional comprehensive university in the Southeastern U.S. A bioethical survey based on an international survey on bioethics by Macer was administered online to undergraduate students with a return rate of approximately 2%. Additionally, this survey was administered to science professors with a return rate of approximately 28%. Interviews were conducted from volunteers on the survey to determine possible ethical approaches to specific answers. The survey data was analyzed first using a series of two-way ANOVAS comparing participant type, gender, religion, ethnicity, and age. These findings were further explored through an analysis of the interviews. Adjustments were made as necessary based on the interview data. It was found that participant type and gender were significant when making bioethical decisions. Ethical approaches yielded patterns with specific answers by revealing the common and uncommon reasoning processes. Additionally, experience with bioethics and bioscience topics positively correlated with acceptance or approval of bioethical scenarios such as genetic modification. These results revealed that experiences and demographics such as gender did affect attitudes and could be used to possibly predict decisions of certain populations, so awareness of these factors and alternative viewpoints are important to consider when discussing or teaching about bioethics. These findings validate that bioethics and bioethical decision-making needs to be included across the educational spectrum.

Keywords: Bioethics, Ethics, University, Undergraduate, Science

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Chapter 1: Introduction

Rationale

Bioethics is important to determine fairness, provide guidelines, and ensure minimum harm in the sciences by raising ethical sensitivity, knowledge, and judgement (Ekberg, 2016; Itai et al., 2006). According to Ekberg (2016), bioethics education is not being adequately addressed despite its importance in preparing students for ethical decision-making in their careers. In fact, a study by Pegoraro and Putoto (2007) revealed many institutions did not even know who was responsible for teaching bioethics while research by Garrett (2004) reported it was common for instructors to spend less than 5% of class time on ethics. Biosciences are expanding and advancing quickly (Ekberg, 2016). Despite this, ethics in the biosciences are not adequately being addressed or taught, especially when compared to the teaching of medical ethics which is an important component of medical training (Ekberg, 2016). There have been attempts to improve these issues, but the lack of adequate coverage still prevails. Acknowledging factors that affect bioethical decisions can help improve educational methods by allowing instructors to tailor education based on the demographics and factors of their classrooms. Instructors will not only be able to craft targeted examples to use in instruction but they can see what viewpoints need to be addressed in their classrooms. This will provide students with the ability to see alternative points of view they may not have previously thought existed.

Despite the lack of bioethics instruction, both students and teachers alike find bioethics and bioethics education to be an important part of their field (Dehghani et al., 2015; Ekberg, 2016; Lau, 2010; Pegoraro & Putoto, 2007). Since bioethics is highly valued, it is important to understand what influences these decisions. Several factors such as gender, religion, age, culture,

and experience are correlated with ethics decision-making outcomes (Dehghani et al. 2015; Haude et al., 2017; Rajiah & Venaktaraman, 2019). Awareness of these factors will and allow an examination of possible biases when making bioethical decisions.

Bonde et al. (2013) and Pasternak (2012) explained several ethical theories that can be used to explain the reasoning behind an ethical decision. For instance, the consequentialist theory explains how a decision maker weighs the benefits and harms of an ethical decision to make their choice. Utilizing these theories could allow a more thorough understanding of different ethical approaches, which is important to consider. Since a well-rounded thought process regarding ethical decisions (especially those affecting the public) is desired, studying factors affecting bioethical attitudes and different ethical theories allows for a careful study of ways to support an individual to become a more skilled bioethical decision maker.

Purpose

Bioethics can be defined as a combination of philosophy and science that involves ethical considerations of health and science within these respective fields (McWhirter, 2012; Ten Have, 2012). Since bioethics covers such a wide range of topics, it is important to consider a wide variety of perspectives. While there are a many studies on factors affecting ethical attitudes in different fields (Choe et al., 2013b; Dehghani et al. 2015; Haude et al., 2017; Rajiah & Venaktaraman, 2019; Song et al., 2010), there is a lack of studies that examine factors affecting different groups in the same study. This study addressed this by including and comparing three cases which included science professors and instructors at the same University, science major undergraduates, and non-science major undergraduates. The science instructors' group (physics, geology, geography, biology, chemistry) addressed whether or not experience plays a strong role in bioethical attitude since multiple previous studies show that it does affect ethical decisions

(Dehghani et al. 2015; Rajiah & Venaktaraman, 2019). This study used interviews to identify ethical approaches and theories that may correlate with these factors, which will in turn allow for better understanding of a variety of viewpoints in bioethical decision-making (Bonde et al., 2013; Pasternak, 2012).

Based on a thorough literature review as seen in Chapter 2, the research questions addressed were as follows: What factors matter at UNCP when undergraduate students have to make an ethical decision? How do the bioethical views of undergraduates in chemistry, biology, physics, geology, and geography majors compare to undergraduate students of other majors? What are the differences/disparities of bioethical views of chemistry, biology, physics, geology, and/or geography professors versus undergraduate students not of those majors at UNCP? Are there any other categories that affect bioethical views at UNCP, such as gender or religion? The purpose of this study is to better understand what factors affect bioethical attitudes and how bioethical views differ between, science professors, science student majors and non-science student majors. It was hypothesized that the science professors would have the most informed bioethical view, followed by the science undergraduate students, and then that the non-science undergraduate students would have a naive or uninformed understanding of bioethical situations. It was also hypothesized that other demographics such as gender or religion would have some type of relationship regarding bioethical decisions.

Limitations

This research study had a few limitations. It occurred at only a single medium sized university in the southeastern United States. The sample size was small and unevenly distributed. The number of interviews that were possible was limited. The study was conducted during a pandemic so all research by University IRB requirements had to be conducted online. A longer

and more in depth follow up study could reveal stronger patterns or relationships within the data or possibly different results and conclusions. There is also a lack of similar studies addressing multiple majors and groups of individuals within a single study.

Chapter 2: Literature Review

Bioethics History

Bioethics is a discipline that combines both philosophy and science (Ten Have, 2012). It involves the ethical considerations of science and health professionals within science and medical fields (McWhirter, 2012). Bioethics is involved in a variety of situations, from conducting research to assisting others with their health. The partnership of bioethics and these situations has been around for many years. In fact, modern bioethics still has origins from the fourth century BCE Hippocratic Oath (McWhirter, 2012). However, despite the ancient beginning of bioethics Van Rensselaer Potter is credited for first mentioning the term "bioethics" in a publication in 1970 (Ten Have, 2012).

Bioethics is occasionally used synonymously with "healthcare ethics", "clinical ethics", or "biomedical ethics" (Lowey, 2002; McWhirter, 2012). While these terms are similar, it should be noted they are not the same. Bioethics is a broader and more interdisciplinary term than healthcare ethics. Healthcare ethics refers to ethical situations and issues relating to illness and health (Lowey, 2002). Bioethics includes healthcare ethics; however, it also includes other biological problems and scientific research (Lowey, 2002; Ten Have, 2012).

Bioethics as a concept came to Potter during a eureka moment. Potter realized current scientific knowledge needed to be intertwined with moral judgements to ensure the survival of mankind and to improve future qualities of life (Ten Have, 2012). As a cancer researcher, Potter grew increasingly concerned with philosophical future issues (Ten Have, 2012). He took inspiration from Margaret Mead, an anthropologist who argued the importance of determining future culture outcomes based on current knowledge. Mead argued to determine what should

happen in society one needs to consider what possibilities could happen and which scenarios are likely to occur due to current circumstances (Ten Have, 2012). Using this thought process, Potter realized scientific knowledge was quickly accumulating but was not being managed or used to predict long term effects or goals (Ten Have, 2012). Thus, Potter hoped to use this broader, more interdisciplinary view of bioethics to improve problem solving, include the implications of scientific research, and to act as a cultural bridge.

Much to Potter's disappointment, bioethics initially steered away from its interdisciplinary approach. Up until the 1990's, ethics in scientific fields were mostly regarded as necessary in just medical fields (Ten Have, 2012). Considering the blatant medical ethical events brought to light such as the Tuskegee syphilis experiment, it is no surprise people started to heavily focus on medical ethics at that time. Additionally, Potter's publication on bioethics at the time was found to be confusing, complicated, and difficult to summarize (Ten Have, 2012). This led to his work being unrecognized for a while. However, Potter did not lose hope and he continued to develop his idea of global bioethics. Potter's publications on global bioethics further explained the interdisciplinary bridge of science and morals. The publications covered how the (at the time) narrow minded concept of bioethics needed to be expanded to include global issues (Ten Have, 2012). The concept gained acceptance and bioethics now covers social science, the environment, agriculture, research, mental health, public health, clinical practices, and more (Lowey, 2002; McWhirter, 2012; Ten Have, 2012).

Modern Bioethics Examples

There are many scientific endeavors that involve bioethics. A survey by Macer (1994) pointed out several situations for participants to consider. For example, genetic disease. If someone carries a genetic disease, who has the right to know such information? How much

autonomy should be provided to someone if their disease affects someone else, such as a child? In the United States, 185 participants said yes to revealing such information to a spouse while only 7 participants said no; however, only 26 participants said yes to revealing information to an employer and 129 said no (Macer, 1994). In fact, it appears both public and student participants of all 10 countries in this study agreed that the information should be revealed to a spouse, but maybe not to an employer. While this bioethical decision shows strong favoritism to one side, it is not a complete consensus. For example, who makes the final decision whether personal genetic information should be disclosed or not?

Another great example of a bioethical situation mentioned in the study by Macer (1994) is genetically modified organisms. The United States participants appeared to be open to a chicken being made less fatty by the addition of genes from another animal (public: 40 acceptable, 40 unacceptable, 20 don't know; students: 42 acceptable, 27 unacceptable, 31 don't know). However, other countries in the study, such as Japan, had a more split decision and even leaned toward finding that making a chicken less fatty by adding genes from other animals was unacceptable (public: 20 acceptable, 41 unacceptable, 39 don't know; students: 30 acceptable, 35 unacceptable, 35 don't know) (Macer, 1994). Such conflicting results revealed just how complicated it can be when determining the best bioethical decision to make; when people cannot agree, issues will of course arise. This raises the question of what should be done when bioethical opinions are so split? It is obvious that other factors such as social, culture, and/or gender are at play.

Bioethics and the Public

Bioethical decisions commonly affect the public even if the public is not necessarily highly educated in such issues. Since these decisions can affect them, it would make sense to

involve them in the decision-making processes in some way. In fact, a study by Macer (1994) revealed that of the ten countries tested, every society showed some sort of "bioethical maturity". In other words, the public commonly mentioned on the survey both the benefits and the harms of different scientific scenarios. Such ability to acknowledge both sides implies the public sees science as a complex subject that is not to be taken lightly (Macer, 1994).

Personal experiences also play a role in public perception of bioethics. In a study by McKendree et al. (2014), 798 United States households were surveyed about animal welfare. It was determined that households with dogs or cats as pets appeared to be more concerned about animal welfare likely due to the emotional connection to their pets (McKendree et al., 2014). For example, pet owners (n=518) had a higher average of concern for livestock domestically produced for food production at 4.46 (1 is low concern, 7 is high concern) while non pet owners (n=280) had a lower average of 3.88 for the same question (McKendree et al., 2014). This study shows how the public and average households are affected by their personal experiences when concerning bioethical scenarios, thus awareness of experiences is needed when regarding an ethical decision affecting the public.

Making Bioethical Decisions

Decision-making is a complicated task. Mintzberg and Westley (2001) suggested people come to a decision using three different approaches. The first approach they suggested was "think first", which is an approach that involves long and careful consideration of the problem. This method is associated with science and a rationale of define, diagnose, design, and decide (Mintzberg & Westley, 2001). The drawback to this approach is possible overthinking which leads to excessive time spent on a single issue. However, due to the complicated nature of ethical problems, one can argue it is appropriate to spend a good amount of time thinking critically

while trying not to overthink (Zhong et al., 2010). Mintzberg and Westley (2001) also suggested a "seeing first" approach. In this method, an individual sees some part of the solution and has an epiphany. This visualization method seems to be common among the arts. Finally, Mintzberg and Westley (2001) suggested there is a "doing first" approach. In this approach, craft and spontaneity is valued. A possible solution is implemented simply to see what happens. All these approaches need to be kept in mind when regarding decision-making; however, some approaches tend to be valued for bioethical decisions over others such as the science related "thinking first" (Borry et al., 2004; Mintzberg & Westley, 2001).

While thinking first is highly valued in science related decisions, the issue of overthinking can cause problems when making an ethical decision. A study by Zhong et al. (2010) examined how ethical a set of decisions were in relation to the amount of time provided to make such decisions. The study included 141 Master of Business Administration (MBA) students from the United States, Germany, and Canada; participants were asked to rank 4 decisions, based upon a presented problem, from their most to least likely action. Various amounts of time were provided between each problem. The ranking of actions was later given an ethical score and compared to other participants and questions. Results showed that when problem order was used as a measure of deliberation time, ethicality decreased with each phase (Zhong et al., 2010). These results imply that more time to decide led to overthinking, a distinct issue with the "think first" approach previously mentioned (Mintzberg & Westley, 2001; Zhong et al., 2010). This begs the question of how much thinking is too much when making a bioethical decision, especially since it needs careful evaluation? How can overthinking be avoided?

Bioethical decisions can be broken down into three parts: description of the question, assessment of the question, and evaluation of the decision (Borry et al., 2004). Each part can

utilize empirical research to improve "thinking" and even "seeing" approaches (Borry et al., 2004; Mintzberg & Westley, 2001). In describing the question, research can assist defining the what, where, why, how, who, and when of the problem. When assessing the question, research raises awareness of possible implications of practices/solutions and any alternatives that are available. Finally, when evaluating decisions research is necessary to examine actual outcomes, unforeseen effects, and to develop new research for future use (Borry et al., 2004; Mintzberg & Westley, 2001). It is clear why research is used throughout the bioethical decision-making process; it assists in logical "thinking" and evaluation. Perhaps research can be used to avoid overthinking while becoming educated on a bioethical topic to make an informed decision.

Theoretical Framework- Ethical Theories

Bioethics involves making ethical decisions. Decision-making in ethics is highly dependent on the process of ethical reasoning. Ethical reasoning is how an individual determines their decision on an ethical dilemma (Pasternak, 2012). The different ways an individual can "reason" out an ethics situation can be explained by ethical theories, which is the criteria an individual uses while evaluating (Bonde et al., 2013; Pasternak, 2012). While there are several theories, in this study three theories were used with subcategories based on previous research by Bonde et al. (2013) and Pasternak (2012).

The first theory category is the consequentialist theory. This theory involves individuals whose main concern is the consequences of a decision (Bonde et al., 2013). This theory can be divided into 3 subcategories. The first subcategory is the utilitarian approach. Those who use the utilitarian approach are weighing the general good and the harm of an ethical decision and go with the option that provides the most good in comparison to the possible harm (Bonde et al., 2013; Pasternak, 2012). For example, if an individual approaches the situation of gene therapy

from the angle of eliminating the chance of a fatal disease gene, a utilitarian may reason the chance of a rare complication from the procedure does not outweigh absolute death from the fatal disease. This is a very common approach to ethical dilemmas and does not involve strictly just the benefits of an individual or a society only. The second subcategory of the consequentialist theory is the egotistical approach. The egotistical approach involves more self-interest than the utilitarian approach. Someone with an egotistical approach is more concerned with how an ethical decision will personally benefit them as an individual and is concerned less about what decision is best for society (Bonde et al., 2013; Pasternak, 2012). For example, when debating if an insurance company should know about a genetic disease an egotistic individual may reason they should not tell the insurance company since the individual does not want their rates to increase. The third subcategory of the consequentialist theory is the common good approach. This approach is concerned with what is best for everyone and all of society (Bonde et al., 2013). Common good individuals are not concerned with individual desires or choices. For example, an individual may support mandatory vaccinations to protect those who cannot get them for medical reasons. A common good individual does not care about an individual's right to choose if it affects society as a whole.

The second theory category is the non-consequentialist theory. Non-consequentialist theory individuals are mainly concerned with the current intent of the individual making the ethical decision and are not concerned with the consequences out of their control (Bonde et al., 2013). This theory can be divided into three subcategories. The first subcategory is the duty based (also known as the deontological) approach. This approach is based on a sense of obligation or duty (Bonde et al., 2013; Pasternak, 2012). For example, an employee with this approach may feel obligated to report their genetic disease to their boss since it is company

policy. This employee would not be concerned with the consequences of reporting their disease; they would just focus on the urge to report out of a sense of obligation to their job. The second subcategory in the non-consequentialist theory is the rights-based approach. This approach is focused on the protection of the rights of those affected by the ethical decision (Bonde et al., 2013; Pasternak, 2012). People with this approach believe individuals should be free to do almost anything if it does not harm or intend to harm other individuals (Pasternak, 2012). For example, an individual may support gene therapy becoming widely available because they believe it comes down to someone's personal choice to use it or not. The third subcategory of the non-consequentialist theory is the justice (sometimes known as the fairness) approach. This approach is only concerned with making the decision that affects everyone equally, good or bad (Bonde et al., 2013; Pasternak, 2012). For example, an individual with the justice approach may support gene therapy only if there is cheap access in low income areas since that would make the opportunity equal for everyone to take.

The final ethical theory category is the agent-based theory. The agent-based theory is concerned with the overall ethical standing of an individual at the time of the ethical dilemma (Bonde et al., 2013). This theory has one main approach: the virtue approach. The virtue approach uses an individual's ethical history when making an ethical decision that affects said individual (Bonde et al., 2013). This is especially applied when the decision involves consequences. For example, if someone harmed the environment by littering, but they do not have a history of this, a virtue-based individual may support "no penalties, just a warning" for the first-time litter bug.

Learning the general ethical approach of a group could allow better predictors of bioethical attitude and understanding why that group or individual made that ethical decision.

Additionally, examining which approaches are most common may assist the development of bioethics education. Using the most common approaches when teaching will make the lessons more relatable to a larger audience. It is also useful to know the less common approaches so that they may be addressed in education and used to help individuals learn to see the diversity of reasonings behind ethical decisions.

Bioethics Education

Biosciences are expanding and advancing quickly (Ekberg, 2016). Despite this, ethics in the biosciences are not adequately being addressed or taught. For example, in a study by Pegoraro and Putoto (2007), out of the ten countries studied, many institutions did not have clear definitions of who was even responsible to teach bioethics. Additionally, a study by Itai et al. (2007) had nine questionnaires returned unanswered due to the lack of someone overseeing bioethical education. Zaikowski et al. (2004) even reported most undergraduate science programs did not require an ethical course or workshop. Booth and Garrett (2004) reported of 151 genetic instructors surveyed, a majority reported less than 5% of class time was spent on ethics. This lack of responsibility conflicts with the notion that bioethical education is regarded as highly important and is even needed to be taught in the field to improve ethical issue understanding (Booth & Garrett, 2004; Choe et al., 2013b; Dehghani et al. 2015; Ekberg, 2016; Pegoraro & Putoto, 2007; Zaikowski et al., 2004). Both the healthcare and the bioscience side of bioethics struggles from these adequate education issues.

The healthcare side of bioethics focuses on clinical ethics and the provider-patient relationship. It is commonly taught among healthcare students. The biosciences side of bioethics is more focused on research ethics and the societal impacts of science. It has only recently gained attention in the curriculum of bioscience students (Ekberg, 2016). This is alarming considering

the importance of bioethics education (Ekberg, 2016; Itai et al., 2006). Ekberg (2016) listed several reasons for the importance of bioethical education for students. The first reason is that it will help students realize the implications of bioscience developments on society, which is also referred to as ethical sensitivity. The second reason is that it will give students the knowledge to respond to public concerns about bioscience impacts on society, which is also known as ethical knowledge. The third reason mentioned by Ekberg is that it will help students understand theories and principals relating to making ethical decisions and provide tools for justifying said ethical decisions. This is simply known as ethical judgement. Itai et al. (2006) also listed similar reasons for bioethics education importance from their study respondents (raise awareness and sensitivity, teach methods of reasoning, increase ethical knowledge). This shows that despite a large time gap between these studies, the purpose and importance of bioethical education has changed little except maybe becoming more important as science advances.

Even non-science majors can utilize general ethical education. For example, business ethics may slightly differ than bioscience ethics; however, these ethics still exhibit the same principles of awareness and moral reasoning (Ekberg, 2016; Lau, 2010). In a study by Lau (2010), results of an Attitudes Towards Business Ethics survey suggested ethics education did improve awareness and reasoning in students. A sample of 707 undergraduate business students were tested. Over 65% of student participants agreed an ethics course can help them in bettering their decision-making processes. In a separate study by Choe et al. (2013a), 69.9% of nursing students (n=1223) and 50.7% of nursing faculty (n=140) tested agreed ethics education was helpful for stimulating ethical awareness. Another study by Dehghani et al. (2015) revealed that several of their 30 nurse participants saw bioethical education as a way to update currently accepted practices. In other words, bioethics should be retaught to those who have already

learned it to ensure a current ethical grasp. These studies show the takeaway from an ethical course is high, so it should be included for bioscience majors and non-majors alike.

Ethics education and specifically bioethics education can provide advantages to bioscience students who have it compared to those who do not. For instance, students who go into research can utilize knowledge from bioethics education to better address ethical and social consequences of their studies (Ekberg, 2016). These students may be able to compose proposals or grants in a more detailed manner and address ethical issues they may not have thought about before their bioethics education.

Current Teaching Practices

Bioethics education is not meant to focus on facts and set answers. A good bioethics module will encourage students to think about different views, ask questions, research what information is available, make informed decisions, and change their mind if alternative information becomes available (Ekberg, 2016). The approach to teaching bioethics in an effective manner are still debated. The determination of how compulsory it should be, when it should be taught, how it should be taught, who should teach it, what topics should be covered, and what assessments should be used vary widely according to who you ask (Ekberg, 2016). For instance, Pegoraro and Putoto (2007) found that of the 50 institutions surveyed in Poland that did not have concrete bioethical education, 42% showed an unprompted desire to improve bioethical training for staff. It can be overwhelming when deciding how to tackle bioethical education, especially if an institution has no previous background for doing so. However, the consensus is bioethical education needs to improve for all students and individuals in bioscience related fields (Choe et al., 2013b; Ekberg, 2016; Pegoraro & Putoto, 2007).

There are a wide variety of practices currently utilized to teach bioethics and other ethics education. A few common methods are case studies, lectures, interactive seminars, group discussion, and debates (Choe et al., 2013a; Ekberg, 2016; Pegoraro & Putoto, 2007; Wada et al., 2013). While lectures may be great for getting out the basic information, case studies provide real world examples. Seminars, debates, and discussions provide opportunities for student interaction. Performing arts can even be used to have students act out ethical scenarios, especially medical students when mimicking patient interaction (McCullough, 2012). A study by Choe et al. (2013a) revealed that out of 1223 student participants and 140 faculty participants involved with nursing programs, lectures based on case studies and theories was the most common teaching approach to their ethical courses (32.8% students, 30.8% faculty). The second most common approach was lectures based on theories (no case studies) with students reporting at 24.1% and faculty reporting at 20.5%. The least used teaching method was debate based on theories (students 3.2%, faculty 5.1%). The participants in this study appeared to be very familiar with lecture style ethics courses and least familiar with debate style courses.

In a separate study by Ekberg (2016), 16 bioscience lecturers from different United Kingdom universities were given a questionnaire utilizing the Likert scale (1= strongly disagree, 5= strongly disagree). The results showed the least favorite teaching style was traditional lecture (median score 2, interquartile range 1-3) (Ekberg, 2016). The most favored teaching style was combining lectures, case studies, and seminars (median score 4, interquartile range 4-5) (Ekberg, 2016). A combination approach of teaching styles was also most popular in the previously mentioned study by Choe et al. (2013a). It appears that bioethics education, when utilized, is currently taught from several angles, which is quite useful for teaching multiple topics in different and engaging ways.

Student Experiences and Opinions

Bioethics education appears to be lacking for several reasons, which is causing a gap in student ethical knowledge and confidence (Ekberg, 2016). Two separate studies carried out in South Korea examined science, engineering, and nursing students' experiences with and opinions about bioethics. Both Choe et al. (2013b) and Song et al. (2010) used surveys as a means of determining bioethical knowledge of students. Choe et al. (2013b) discovered that, out of the 1225 undergraduate nursing students surveyed, only 8.8% stated they had considerable knowledge of bioethics. This number is low when considering how the medical field faces bioethical situations every single day. Students lacked confidence in the knowledge they had and/or were missing knowledge. While this number is concerning, Song et al. (2010) suggested that non-science majors could yield even lower scores of bioethical perceptions, especially regarding research. Song et al. (2010) surveyed 210 science students and 462 engineering students. Song et al. found that the science students did understand ethics more than the engineering students using a 5 point Likert scale questionnaire regarding perception of research ethics. Additionally, when examining the perception levels of all students, plagiarism and falsification had lower mean scores than fabrication in regards to student awareness relating to these issues. These results suggested that while knowledge levels vary between majors, overall bioethics knowledge still needs to be addressed for all students. In fact, Choe et al. (2013b) ranked students' "ethical knowledge" (n= 1225 with a mean of 3.17 +/- 0.83) as the lowest item needed for good ethical qualification of a person. Improving ethics courses could greatly improve this number and allow for knowledge to become a more highly valued factor in ethical qualification. Choe et al. also suggested education can be improved by acknowledging a society's culture and highly talked about issues. For example, Korea's nursing students stated

abortion was the most serious bioethical problem; this thought process makes sense when acknowledging how population control used to include government mandated abortions, but now such procedures are severely restricted even though the "prefer a boy" mindset still exists within the country (Choe et al., 2013b). Acknowledging such issues could improve student confidence and give guidelines for the "less thought about" issues to be thoroughly discussed to ensure students are aware of the seriousness of all issues.

Choe et al. (2013b) also suggested bioethics education needs to be approached in a modern way due to media information from multimedia outlets such as TV, social media, and non-profit organizations. This is supported by the findings of Song et al. (2010) that found in their study that 32.1% of all students they tested (n=672) claimed their first information source on bioethics was from mass media, which is closely behind the 34.2% claiming school was their first source. Bioethical learning could be improved in many interesting ways, such as discussing ethical dilemma scenes of medical dramas. Teachers could also add more case studies and discussion since students seem to prefer these methods (46.9% and 44.9% respectively, n=672) (Song et al., 2010). Another method of modern bioethical education could include an interactive web-based curriculum. In a study by Sehovic et al. (2016), 22 public health graduate student participants took a web-based course on biobanking ethical concerns. This online course included animations and many resources to additional information if students wished to learn more. The results showed that 77% of students had a higher test score after the course, 14% of students had no change between their pre and post-test scores, and 9% of students had a slightly worse post-test score after the course (Sehovic et al., 2016). These results support the idea that modern teaching using technology has a positive effect on students learning about bioethics. Using preferred and relatable methods are bound to make ethics education understandable, more

engaging, and more relatable for students which should in turn increase their own bioethical knowledge, attention, and awareness.

Students of many types believe the value of ethics education. In a study by Lau (2010), 68% of the student participants (n= 707) who had not taken a business ethics course agreed an ethics course should be included in business education while 88% of participants who had previously taken an ethics course agreed it should be included in education. This increase implies students take value from their ethics course and deem it influential and important enough that other students should partake in it. Another study by Wada et al. (2013) revealed psychiatry residents (n= 22) at a Canadian university thought the experience of a bioethics seminar was positive. One resident in this study even stated they believed bioethical education was important to help prevent ethical violations (Wada et al., 2013).

Factors Affecting Ethical Decisions

There are many factors that can affect someone's ethical decision-making. Research has shown that it may be possible to predict a decision based on a combination of factors. For example, common demographics such as age, experience, and gender appear to play a role in ethical decisions (Dehghani et al., 2015; Haude et al., 2017; Rajiah & Venaktaraman, 2019). Organizational factors, such as locations and other individuals around, have even been found to influence the ethical decision-making process (Rajiah & Venaktaraman, 2019). A study by Rajiah & Venaktaraman (2019) examined the ethical dilemmas (challenge to ethical principles based on patient behavior and professional peers) of 742 pharmacists in the Tirunelveli district in India. The results of the questionnaire showed statistical difference in the level of ethical dilemma because of age, work experience, gender, education level, and even pharmacy location (Rajiah & Venaktaraman, 2019). This showed that some pharmacists are more likely to be

ethically concerned for patients' safety and confidentiality than other pharmacists. For example, these results revealed younger pharmacists were more likely to pause and think about filling a prescription when compared to older pharmacists who tended to dispense with little hesitation (Rajiah & Venaktaraman, 2019).

Dehghani et al. (2015) found that experience affects bioethical viewpoints in their qualitative study involving 30 nursing students in Iran. Results showed that participants with high levels of experience were aware of the effects of ethical training on trainees and reflected more on their previous ethical encounters. This suggests that as a student or professional encounters ethical dilemmas throughout their career, they start to more highly regard bioethics as a subject.

Since religion can be extremely important for some individuals it should be considered when providing bioethical scenarios and when examining bioethical reasoning. Haude et al. (2017) found religion could influence bioethical decisions, especially when making personal decisions. In their study, 9 parent participants were interviewed about their thoughts during the process of going through IVF (In Vitro Fertilization) and PGD (Preimplantation Genetic Diagnosis) cycles. Three parents reported religion played a role in their decision to partake in IVF and PGD. For example, one Jewish couple reported they took their IVF and PGD situation to the Jewish court to ensure it was allowed in the eyes of Judaism (Haude et al., 2017). Factors with this much influence on final bioethical decisions cannot be ignored.

Summary

Bioethics is a complex scientific and social dilemma that requires better understanding in order to be addressed. Though bioethics education is regarded as critical in today's scientific

world, the teaching of bioethical decision-making in today's schools is lacking in several ways. Some reasons for this include not having qualified personnel nor agreement upon who should teach the subject and where it should be included (Ekberg, 2016; Itai et al., 2007; Pegoraro & Putoto, 2007). Despite these issues, both teachers and students still find value in ethical education for most fields. In order to increase the effectiveness of bioethical education, increase awareness, and increase ethical consideration of all parties affected, understanding of the many possible factors behind bioethical attitudes and the ethical theories guiding decision-making is crucial. While there are many studies examining such factors of specific groups or individuals (Choe et al., 2013b; Dehghani et al. 2015; Haude et al., 2017; Rajiah & Venaktaraman, 2019; Song et al., 2010), there is a lack of studies comparing the influences between several groups at once. For example, studies that examine ethical experiences among students typically focused on students in one field. The current study compared both science and non-science student attitudes and influential factors at the same time. Additionally, another group consisted of select science instructors to further the understanding of exposure and experiences on bioethical decisions. The current study investigated the following questions:

1) What factors matter at UNCP when undergraduate students have to make an ethical decision?
2) How do the bioethical views of undergraduates in chemistry, biology, physics, geology, and geography majors compare to undergraduate students of other majors?
3) What are the differences/disparities of bioethical views of chemistry, biology, physics, geology, and/or geography professors versus undergraduate students not of those majors at UNCP?
4) Are there any other categories that affect bioethical views at UNCP, such as gender or religion?

Chapter 3: Methods

Setting

The purpose of the current study was to examine factors that affected bioethical decision-making for undergraduate students and bioscience instructors. It was hypothesized that the science professors would have a more informed bioethical view, followed by the science undergraduate students, and finally that the non-science undergraduate students would have a naive or uninformed understanding of bioethics overall. It was also hypothesized other factors such as gender or religion would have a relationship with bioethical decisions. This study received IRB approval in late September 2020 (Appendix A). The study occurred at a medium sized rural and regional comprehensive four-year Master's University in the Southeastern part of the U.S. This minority-serving college has over 8,260 enrolled students and over 295 faculty members. The student demographics of the university are as follows (Table1):

Table 1: Demographics of the University Students

Race	**White/Caucasian**	**Black/African American**	**American Indian**	**Hispanic/ Latino**	**Asian/ Pacific Islander**	**Other**
Percent	39%	31%	13%	8%	2%	7%

Participants

There are approximately 6,436 undergraduate students enrolled and over 60 science instructors in the biology, chemistry, physics, geology, and geography departments, combined. These undergraduate students and instructors were the intended targets of this study. For the survey, 254 responses were received. A total of 86 incomplete and 41 invalid (meaning the

participant was not an undergraduate student or an instructor in the requested categories) responses were removed. This left a total of 127 valid survey responses. The demographics of all the survey responses are as follows (Table 2):

Table 2: Participant Type of Survey Respondents

Participant Type	**Total Number**
Student: Science Major	26
Student: Non-Science Major	84
Instructor: Science	17
TOTAL PARTICIPANTS: 127	

Student survey participants were further divided into classification and science major as follows (Tables 3 & 4):

Table 3: Student Classification of Student Survey Respondents

Student Classification	**Total Number**
Freshman	21
Sophomore	23
Junior	33
Senior	33
TOTAL STUDENTS: 110	

Table 4: Science Major of Science Student Survey Respondents

Science Major	**Total Number**
Biology- General	18
Chemistry	3
Physics	2
Science Education	1
TOTAL SCIENCE MAJORS: 24	

Instructor survey participants were further divided into years teaching as follows in (Table 5):

Table 5: Years Teaching for Instructor Survey Respondents

Years Teaching	**Total Number**
1-5 years	3
6-10 years	1
11-15 years	2
16-20 years	2
21-25 years	5
26-30 years	1
31-35 years	2
36-40 years	1

Religion of all the survey participants are as follows (Table 6):

Table 6: Religion of Survey Participants

Religion	**Total Number**
Christian	84
Muslim	1
Hindu	1
Atheist	8
Agnostic	12
Other	8

Out of all the survey participants, 40 participants volunteered for interviews. Of these volunteers, 18 did not respond to the recruitment email (Appendix B) and 9 were sent a decline email (Appendix C) due to ineligibility, (i.e. not being an undergraduate student or an instructor). There were 13 successful interviews with the following demographics (Table 7):

Table 7: Participant Type of Interviewees

Participant Type	**Total Number**
Student: Science Major	5
Student: Non-Science Major	4
Instructor: Science	4
TOTAL PARTICIPANTS: 13	

Student interviewees were divided further into classification as follows (Table 8):

Table 8: Student Classification of Student Interviewees

Student Classification	**Total Number**
Freshman	2
Sophomore	2
Junior	3
Senior	2

Instructor interviewees were divided further into subject specialization (with some instructors specializing in multiple subjects) as follows (Table 9):

Table 9: Subject Specialization of Instructor Interviewees

Subject Specialization	**Total Number**
Biology	4
Environmental Science	3
TOTAL INSTRUCTORS: 4	

Non science major (those not in chemistry, biology, physics, geology, or geography) undergraduate students were compared to science major undergraduate students to see if scientific experience/knowledge plays a role in bioethical decision-making. Science professors of the science departments mentioned above were included in the study to gauge if years of scientific experience influences bioethical decisions in a particular way. These instructors were compared first to the non-science major students to see if there were any major differences in

thought processes. Any significant differences for the “non major vs. major” and “non major vs. instructor” comparisons prompted further analysis of the “major vs. instructor” groups. This would particularly show if years of science education/experience has an influence on bioethical thought processes.

The thought processes of these participants were placed in an ethical theory approach category (see Appendix D). These thought processes were compared within their group (major, non-major, instructors) to see if there were any patterns. Thought processes were also compared in general between different groups; initially the major vs. non-major and the non-major vs. instructors, and then additionally the major vs. instructors if significant patterns were found between the other groups. Patterns between specific answers and reasonings were also analyzed as a whole (from all groups) to see if any answer had similar reasonings behind it.

Data Collection

Data collection was completed using an online survey and follow up video conferencing interviews. A modified bioethics survey (based on Macer, 1994) (Appendix E and F) was constructed using Qualtrics software (Qualtrics, Provo, UT). The survey had 8 demographical questions and 22 questions about bioethical related issues. The first section of these questions used a 5 point Likert scale. The second section of these bioethical questions used a dichotomous yes or no scale. The final question was free written response. The bioethical questions were in the categories of biotechnology, genetically modified organisms, genetic engineering, genetic diseases, mental illnesses, gene therapy, environmental concerns, patent rights, and privacy rights.

This survey was sent out to all undergraduate students at the University using a campus-wide listserv. The survey was also sent to science instructors, specifically physics, geology, geography, biology, and chemistry departments, at the university (see Appendix F). The survey was sent out by a recruitment email (see Appendix G). An email reminder was sent once per week for two following weeks to further encourage responses (Appendix G). All of these emails to participants contained a short explanation and a survey link (Appendix G). A consent form was included at the beginning of the survey for participants to read and sign (Appendix H). The survey was accessible for three weeks to the participants.

A chance to win a $10 Starbucks gift card was provided within the survey to encourage responses. This opportunity was listed as a voluntary question at the end of the survey (see Appendices E and F). When the survey closed, all volunteers (from all three groups in the study) who provided their name and email were assigned a number. A random number generator selected 10 numbers. Volunteers with one of these numbers were emailed the electronic gift card, and the list of names and emails were then deleted. This information was not connected to the participant's survey answers and was not required to complete the survey.

The survey also contained an optional question at the end to volunteer for a follow up interview (Appendices E and F). Interviews were conducted while the survey was ongoing. Interview volunteers (from the survey) were sent an interview recruitment email if they were an undergraduate student or science instructor (Appendix B). A polite decline email was sent to participants who did not fit into the research study's participant groups (see Appendix C). Interview participants who responded were provided a consent form to read and sign before the interview took place (Appendix I). These participants were asked their thoughts on bioethics and a few of the International Bioethics Survey questions in September-October 2020 (Appendix J).

The interview was conducted by the researcher via WebEx and took approximately 25 minutes to complete. Questions from the survey were shared for the participant to read and discuss. The interview was recorded by via WebEx with consent and also audio recorded. These recordings were transcribed by the researcher and sent to the participants via email for participant checking. When the transcripts were returned to the researcher, they were then analyzed using a qualitative software program called MAXQDA (VERBI Software, 2019).

The researcher also recorded any unexpected issues, changes, and other significant events while the survey and interviews were conducted. This also assisted in keeping track of the types of participants in the survey, who to email for interview volunteers, and interview schedules. When the study was complete the researcher's notes were analyzed and included in the results and discussion.

Data Analysis

This was a mixed methods study with self-reported data (bioethics survey for students and instructors) and descriptive or observational data (bioethics interview for students and instructors, research notes). The survey was analyzed first to see if any significant patterns existed between three cases, the context questions and answers. Patterns were also searched for between specific groups of student science majors, student non-science majors, and instructors (in other words, were there any significant differences in answers between these groups) This was completed by using IBM SPSS Statistics for Windows, version 27.0 using two-way ANOVAS comparing the means to determine if there were significant differences.

Interviews and the written survey response question were analyzed using MAXQDA (VERBI Software, 2019). Unique codes were assigned to different answers to the qualitative

data. The same code was used among participants if the same answer was given. The researcher then placed answers of each participant into an ethical approach group based on descriptive criteria (Appendix D). Each part of the answer given by a participant was classified if possible; multiple approaches were tagged in a single long answer if necessary. Answers were grouped together by participant category: student science majors, student non science majors, and instructors. Any patterns within a category and differences between categories were noted.

The interview data was triangulated with the survey responses by examining the specific questions asked in the interview that were from the survey. Categories of student science majors, student non science majors, and instructors were compared from both the survey and the interview to see if similar answers were present between the two data sources. If answers were similar, it is assumed the ethical approaches for that question and category from the interview can be applied to the larger sample of the survey.

Finally, the research notes were analyzed for any missed patterns or to confirm possible patterns. When the analysis was complete the researcher reanalyzed the data as a whole to come to the final conclusions about the research questions. The complete analysis process is summarized as follows in Figure 1:

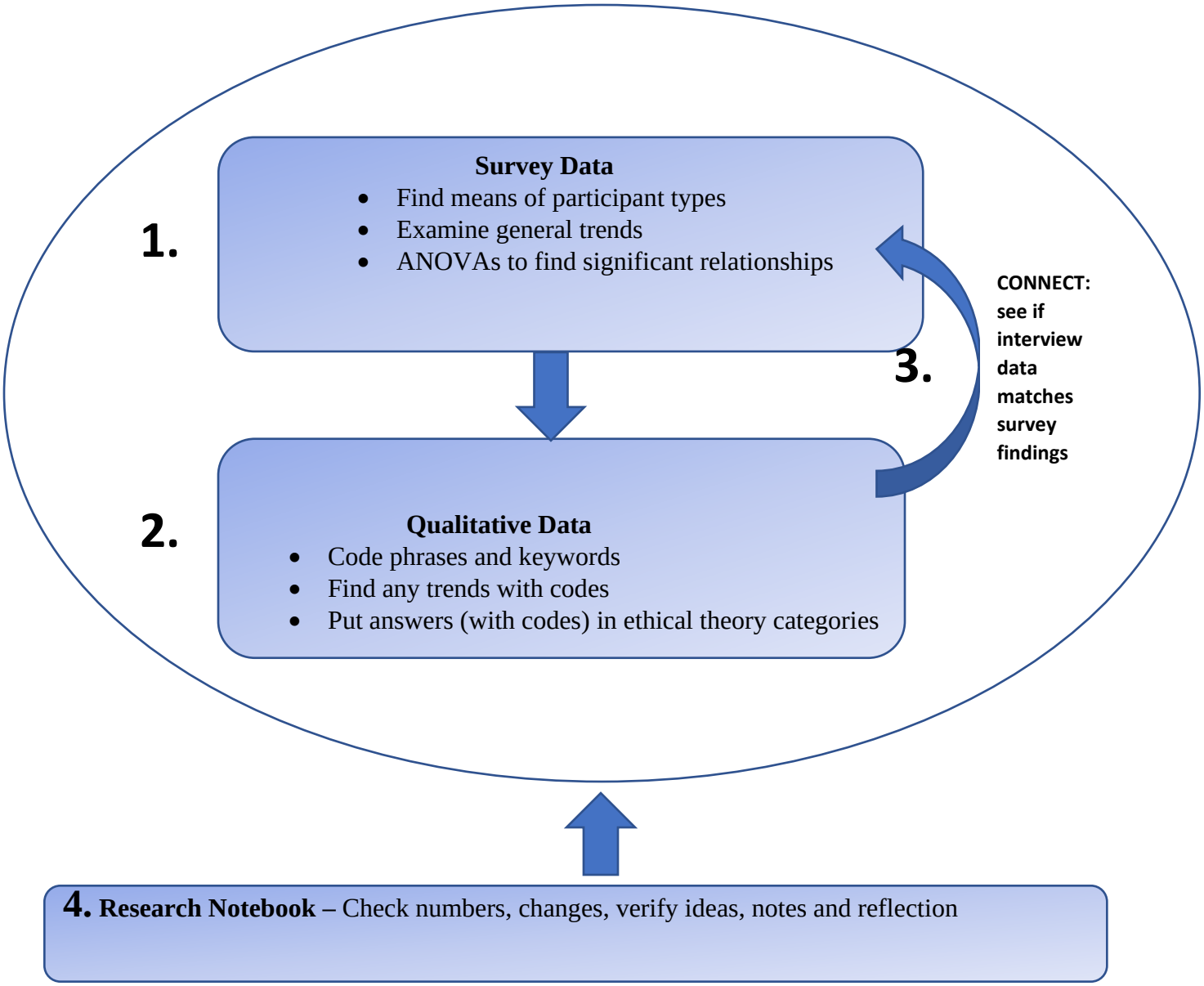

Figure 1: Data Analysis Steps

The data sources and their descriptions for the study are summarized as follows (Table 10):

Table 10: Data Sources and Analysis

Data Source	Quantitative/ Qualitative	Research Question	When Collected	Analysis
Survey-Students	Quantitative-Likert Scale, rankings will be totaled	What factors matter at UNCP when undergraduate students have to make an ethical decision? How do the bioethical views of undergraduates in chemistry, biology, physics, geology, and geography majors compare to undergraduate students of other majors? Are there any other categories that affect bioethical views at UNCP, such as gender or religion?	After 3 weeks of being open	Mean scores each question, search for significant patterns of factors vs answers, ANOVAS
Survey-Instructors	Quantitative-Likert Scale, rankings will be totaled	What are the differences/disparities of bioethical views of chemistry, biology, physics, geology, and/or geography professors versus undergraduate students not of those majors at UNCP? Are there any other categories that affect bioethical views at UNCP, such as gender or religion?	After 3 weeks of being open	Mean scores each question, search for significant patterns of factors vs answers, ANOVAS
Interview-Students	Qualitative-frequency and ethical approach types observed	What factors matter at UNCP when undergraduate students have to make an ethical decision? How do the bioethical views of undergraduates in chemistry, biology, physics, geology, and geography majors compare to undergraduate students of other majors?	Throughout the survey open period	Placement of answers in ethical approach type; relate back to survey for possible patterns

Interview-Instructors	Qualitative-frequency and ethical approach types observed	What are the differences/disparities of bioethical views of chemistry, biology, physics, geology, and/or geography professors versus undergraduate students not of those majors at UNCP?	Throughout the survey open period	Placement of answers in ethical approach type; relate back to survey for possible patterns
Research Journal	Participant Observer	What factors matter at UNCP when undergraduate students have to make an ethical decision? What are the differences/disparities of bioethical views of chemistry, biology, physics, geology, and/or geography professors versus undergraduate students not of those majors at UNCP?	Daily throughout study	Assess entries to find patterns, changes, or perceptions

Summary

This study was completed to determine what factors affect bioethical decision-making in undergraduate students and selected science instructors at a rural university. The bioethics survey showed significant patterns between demographics and particular answers. The survey also showed the differences in answers between participant categories. The interviews revealed the reasoning behind answers on certain survey questions; it also showed the ethical approaches participants may have taken. Since the literature shows demographics, education level, and experiences (especially with science) can affect ethical decision-making, it was hypothesized similar factors affecting bioethical decision-making would be revealed in this study.

Chapter 4: Results

This research study was conducted to determine how undergraduate students at a moderately sized comprehensive public university approached bioethical scenarios in comparison with peers of different majors and in comparison with science professors. Significant findings related to the online modified bioethics are given first, then the interview trends and ethical approaches found from the interviews are analyzed. Based on the research questions, it is hypothesized participant type will affect bioethical decisions due to the differences in experience level. In other words, if the participant has more experience with science they will be more accepting of scientific developments and processes. It is also hypothesized other demographics such as gender and religion will affect bioethical decision-making due to previous findings of other studies showing this to be the case.

Modified Bioethics Survey

The modified bioethics survey consisted of 22 multi part questions and was administered via email using Qualtrics version October 2020 (Qualtrics, Provo, UT). These questions measured the participant's opinion on the topics of environmental issues and organism rights (question 1), scientific research developments (question 3), personal experiences (questions 2, 5), genetically modified organisms (questions 6, 7, 14, 16), genetic disease and illness (questions 8, 9, 10, 18, 21), gene therapy (question 12), genetic testing (question 17), copyright (question 13), who is trustworthy (question 15), biotechnology (question 4) , and privacy rights (questions 19, 20). Variables of participant type and gender were assessed for each question. Other variables such as religion, ethnicity, and age were also examined for question parts 1a, 6c, 6d, 12a, 12b, and 19a-e (which were the questions used in the follow-up interviews). Two-way ANOVAs using IBM SPSS Statistics for Windows, version 27.0 were conducted to test for significant

differences in means for multiple predictor variables related to the participants' backgrounds (Table 11). Those predictor variables not found in Table 11 were not significant for any parts of the questions.

Table 11: Significant Findings Based on Participant Type

Category	Question	Variable	Significance
environmental issues and organism rights	1b) Most problems can be solved by applying more and better technology.	Participant Type	0.049
		Participant Type X Gender	0.028
	1d)Genetically modified plants and animals will help agriculture become less dependent on chemical pesticides	Gender	0.048
scientific research developments	3d) Do you have any worries about the impact of research or its applications of nuclear power scientific discoveries and developments? How much?	Participant Type X Gender	0.001
biotechnology	4)Overall do you think science and technology do more harm than good, more good than harm, or about the same of each?	Gender	0.035
genetically modified organisms	6a) Genes from most types of organisms are interchangeable. Would potatoes made more nutritious through biotechnology be acceptable or unacceptable to you if genes were added from another type of plant, such as corn?	Participant Type	0.022
	6b) Would such potatoes be acceptable or unacceptable to you if the new genes came from an animal?	Gender	0.007
	6c) Would chicken made less fatty through biotechnology be acceptable or unacceptable if genes were added to the chicken from another type of animal?	Participant Type	0.01
		Gender	0.039
	6d) Would such chicken be acceptable or unacceptable if the genes came from a human?	Participant Type	0.003
		Gender	0.002
		Participant Type X Gender	0.026
		Religion	0.005
	7a) If Dairy Products were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?	Participant Type	0.008
		Gender	0.024

	7b) If Vegetables were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?	Gender	0.019
	7c) If Meat were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?	Participant Type	0.034
		Gender	0.013
	7d) If Medicine were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?	Gender	0.013
		Participant Type X Gender	0.029
	14f) If there was no direct risk to humans and only very remote risks to the environment, would you approve or disapprove of the environmental use of genetically engineered organisms designed to produce cows which produce more milk?	Participant Type	0.012
genetic diseases and illnesses	9a) Feelings towards people with hemophilia	Participant Type	0.026
	9b) Feelings towards people with muscular dystrophy	Participant Type	0.031
	10a) Feelings towards people with mental depression	Participant Type	0.025
	12e) Feelings about changing genetic makeup to improve child physical traits	Participant Type	0.001
gene therapy	12f) Feelings about changing genetic makeup to improve child intelligence	Participant Type	0.001
	12g) Feelings about changing genetic makeup to make people more ethical	Participant Type	0.035
copy right	13b) People who create something original can obtain financial reward for their efforts through patents and copyright. Should people be able to obtain patents and copyright for books and other information?	Participant Type	0.03
		Participant Type X Gender	0.004
	13g) People who create something original can obtain financial reward for their efforts through patents and copyright. Should people be able to obtain patents and copyright for a medical treatment or drug to cure AIDS?	Participant Type X Gender	0.028

who is trustworthy	15e) Suppose that a number of groups made public statements about the benefits and risks of biotechnology products. Would you have trust or distrust in statements made by university professors?	Participant Type	0.004
	15g) Suppose that a number of groups made public statements about the benefits and risks of biotechnology products. Would you have trust or distrust in statements made by farmers or farm groups?	Gender	0.014
privacy rights	19a) If someone is a carrier of a defective gene or has a genetic disease, who else besides that person deserves to know that information? Employer	Participant Type	0.032
	19e) If someone is a carrier of a defective gene or has a genetic disease, who else besides that person deserves to know that information? Government Health Organization	Participant Type X Age	0.018
	20b) If someone has HIV (the AIDS virus), who else besides that person deserves to know that information? Insurer	Participant Type	0.03
	20c) If someone has HIV (the AIDS virus), who else besides that person deserves to know that information? Spouse or fiancé	Participant Type X Gender	0.017

Participant type and gender and their interaction (participant type * gender) were found to be the most significant predictors for many questions (Table 11). Ethnicity was not found to be significant while age and religion were significant in only one category each (privacy rights and genetically modified organisms). Some questions, such as questions 6 and 7 (genetically modified organisms), had at least one significant finding for each part of the question. Other questions had several significant findings for one part of the question such as questions 1b (can solve problems with technology), 6c (animal genes in chicken), 6d (human genes in chicken), 7a (concerns of GMO dairy), 7c (concerns of GMO meat), 7d (concerns of GMO medicine), and 13b (books and information copyright).

Significant findings in questions 6 (genetically modified organisms) and 19 (privacy rights) are focused on in this study due to their later use in the bioethics interview. Findings for question 6c (animal genes in chicken) are as follows in Figures 2 and 3:

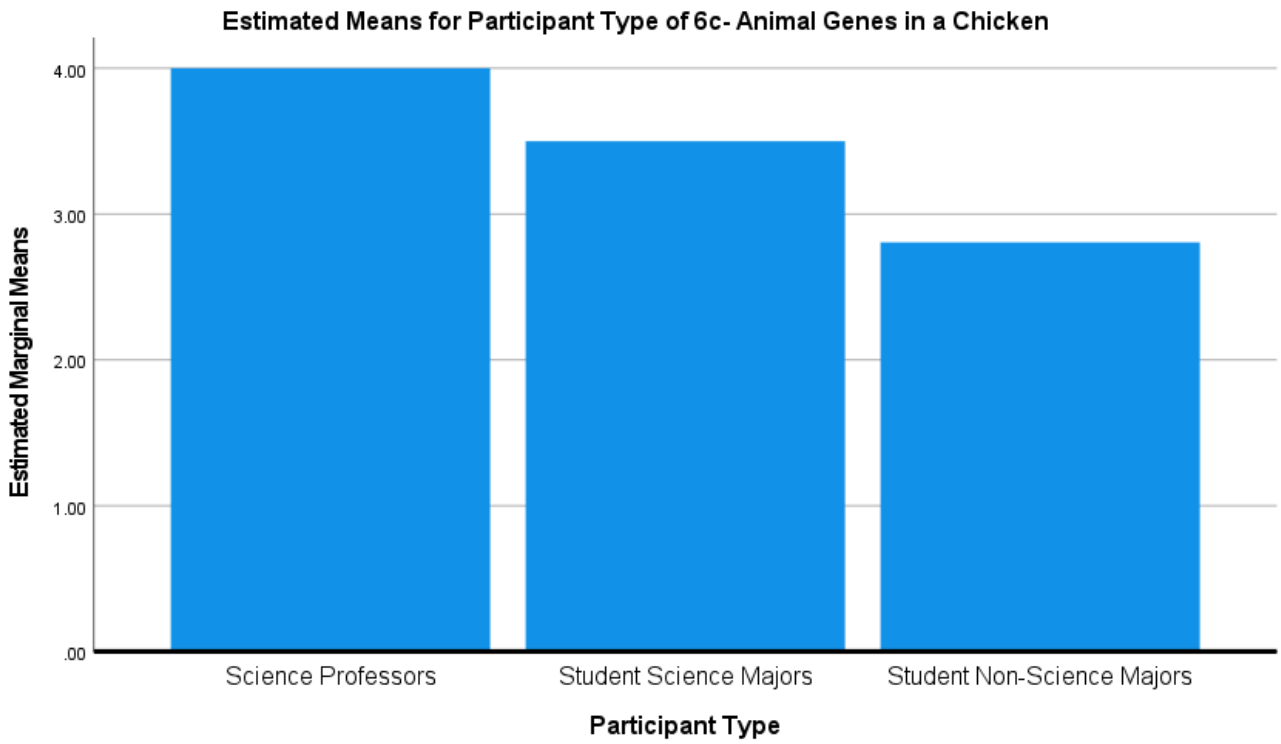

Figure 2: Participant Type Relationship with 6c- Animal Genes in a Chicken

*Mean: 5- Completely Acceptable to 1- Completely Unacceptable

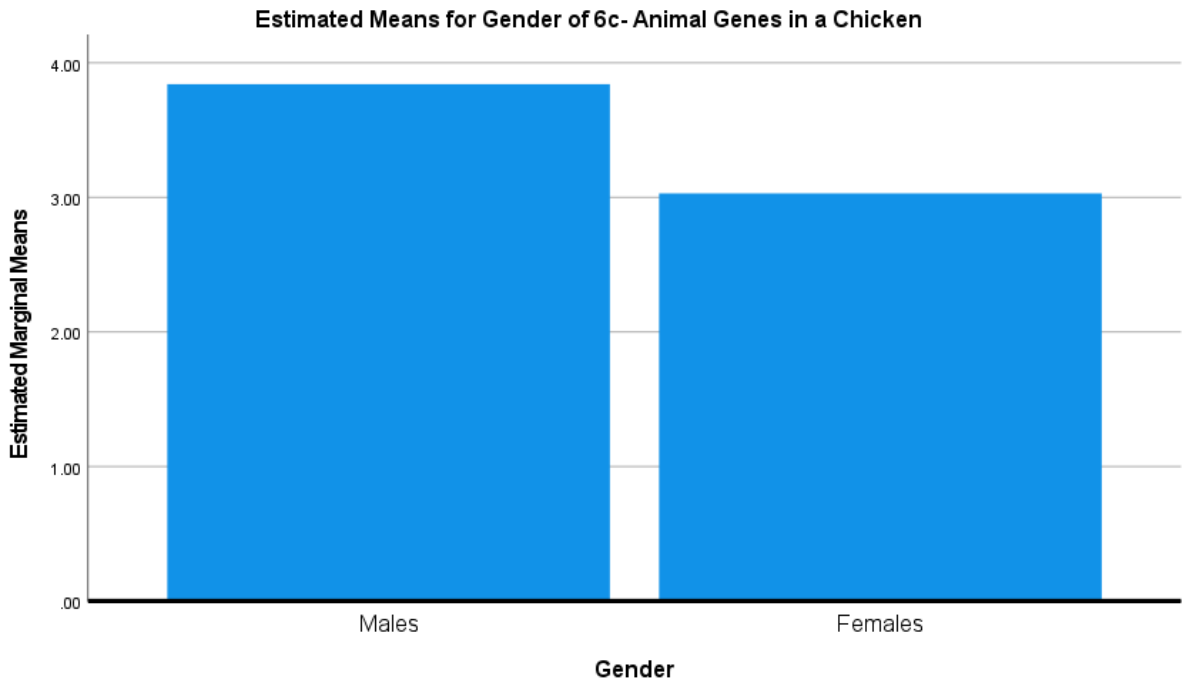

Figure 3: Gender Relationship with 6c- Animal Genes in a Chicken

*Mean: 5- Completely Acceptable to 1- Completely Unacceptable

There was a significant difference of participant type on the acceptability of using animal genes to make a chicken less fatty for question 6c. Professors appear to find 6c acceptable, student non majors found 6c unacceptable. Student science majors fell in between with just slightly favoring "acceptable" (Figure 2). There was a significant difference of gender on the acceptability of using animal genes to make a chicken less fatty for question 6c. Males found 6c to be more acceptable than females (Figure 3).

Figures 4 and 5 below revealed the significant patterns found with question 6d (human genes in chicken):

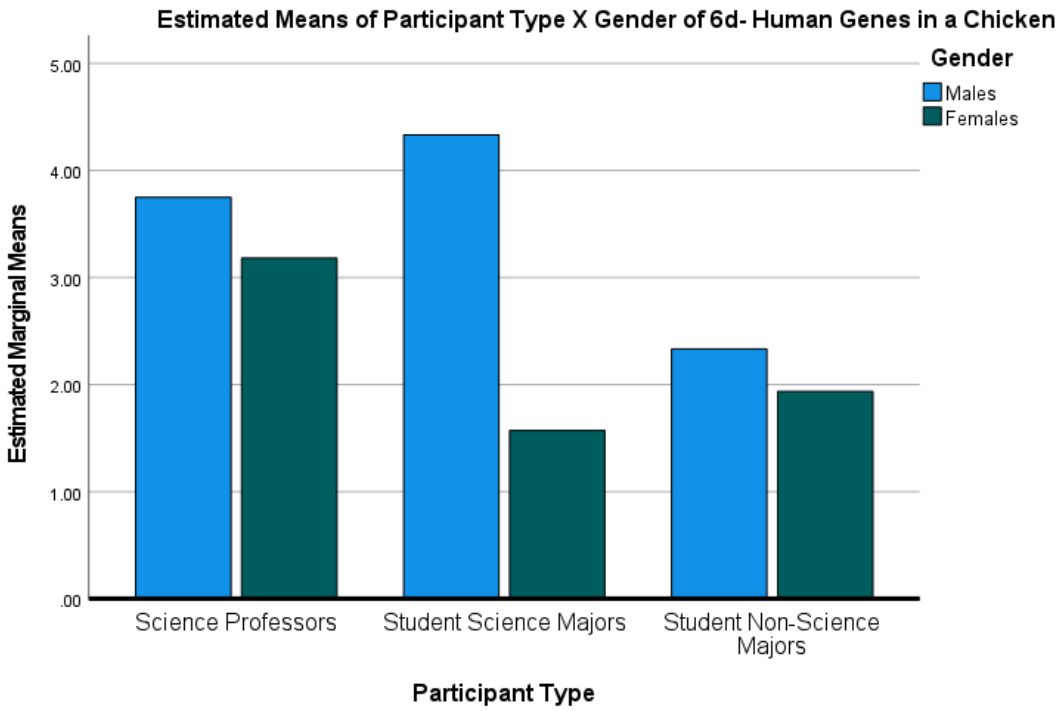

Figure 4: Participant Type and Gender Relationship with 6d- Human Genes in a Chicken

*Mean: 5- Completely Acceptable to 1- Completely Unacceptable

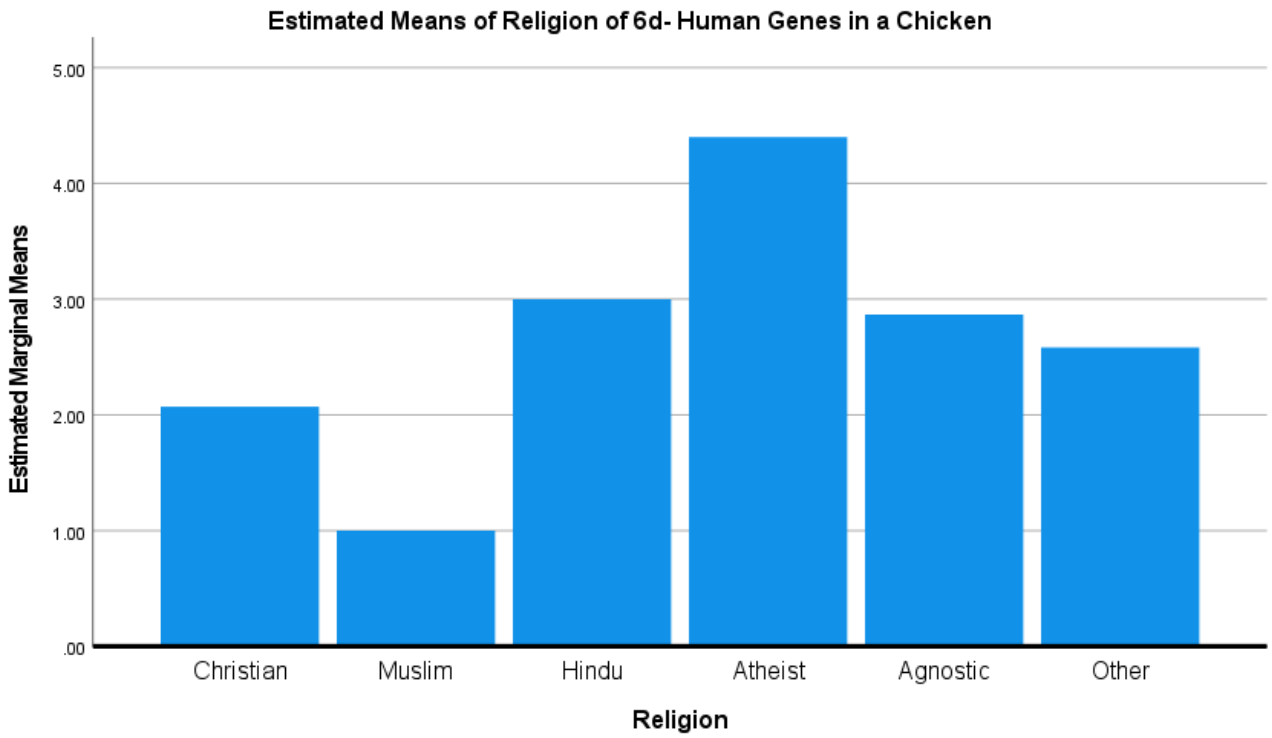

Figure 5: Religion Relationship with 6d- Human Genes in a Chicken

*Mean: 5- Completely Acceptable to 1- Completely Unacceptable

There was a significant difference of participant type X gender on the acceptability of using human genes to make a chicken less fatty for question 6d. Both male and female professors found using human genes in a chicken (6d) to be acceptable on some level. For student science majors, males found 6d strongly acceptable while females found 6d strongly unacceptable. For student non majors, both males and females found 6d unacceptable although males were slightly more lenient than females (Figure 4). There was a significant effect of religion on the acceptability of using human genes to make a chicken less fatty for question 6d. Atheists found 6d the most acceptable. Hindu and agnostic groups were close to neither acceptable nor unacceptable. Muslim showed the lowest unacceptable result followed by Christians (Figure 5).

Question 19 (privacy rights) focused on who should know about a genetic disease or trait you may carry. Figures 6 and 7 below reveal the relationships found within this question:

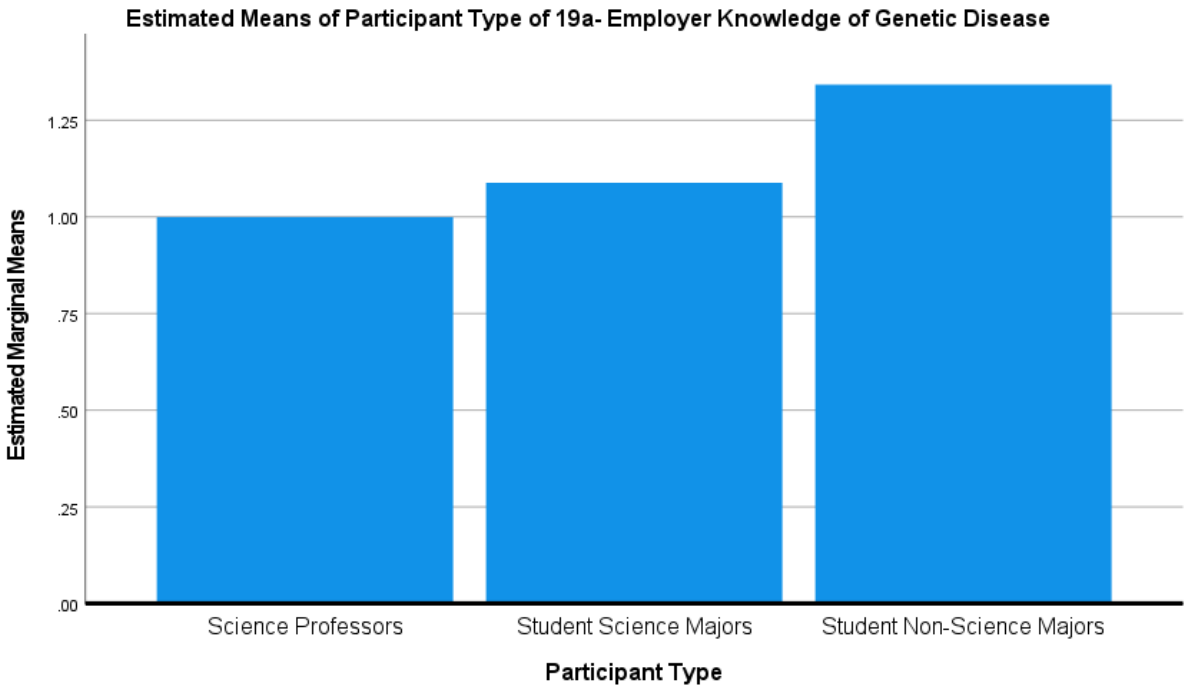

Figure 6: Participant Type Relationship with 19a- Employer Knowledge of Genetic Disease

*Mean: No-1, Yes-2

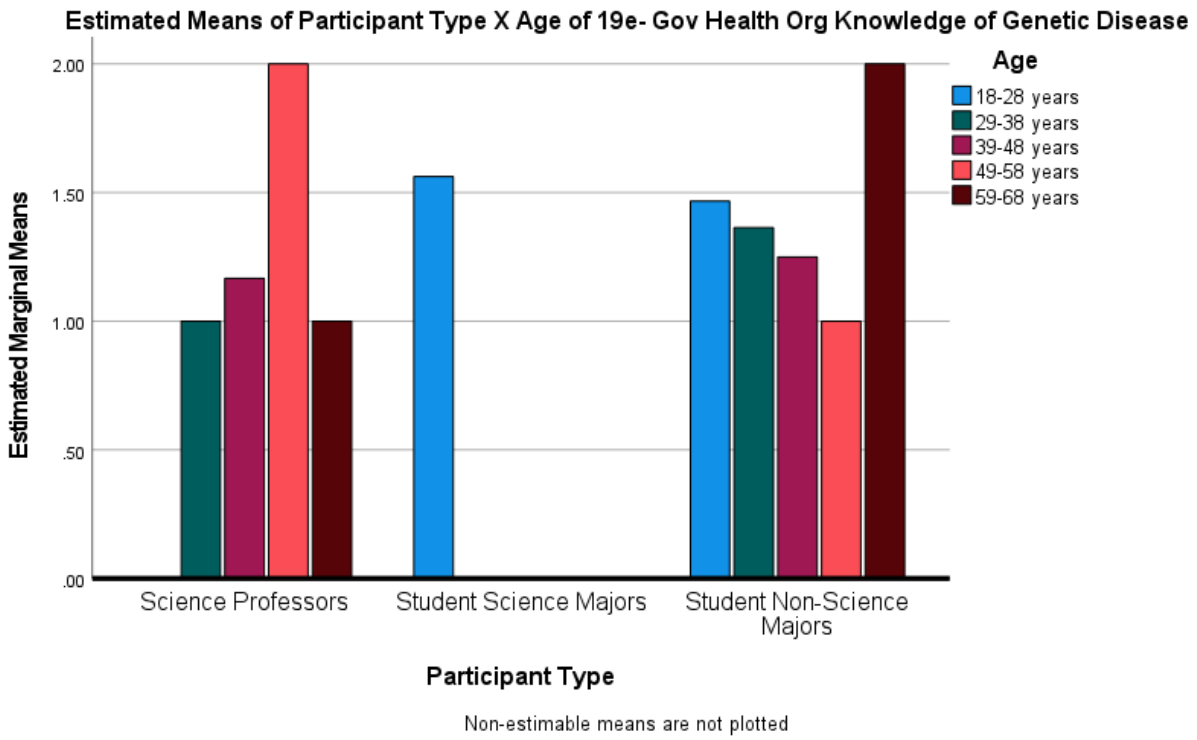

Figure 7: Participant Type * Age Relationship for 19e- Gov Health Org Knowledge of Genetic Disease

*Mean: No-1, Yes-2

There was a significant effect of participant type on employers' knowledge of genetic diseases for question 19a. Professors thought employers should not know about one's genetic disease situation. Student non majors had the highest likelihood of telling an employer their genetic disease situation (although still on the "do not tell" side) and student science majors fell in between the professors and student non majors (Figure 6).

There was a significant effect of participant type X age on government health organizations' knowledge of genetic diseases for question 19e. For professors, all age groups appear to not want to reveal such information except for the 49-58 age group which

overwhelmingly supported telling government health organizations about their disease. Student science majors only had one age group (18-29) who answered this question; they were split about whether to tell or not tell a government health organization about their genetic disease situation. For student non majors, the likelihood of someone telling a government health organization their genetic disease situation decreased as age increased until the 59-68 age group who overwhelmingly supported telling a government health organization their disease situation (Figure 7).

Bioethics Interview

The bioethics interview was conducted with a volunteer after they completed the modified bioethics survey. The questions for the interview consisted of background information on the participant, their definition of bioethics, and the participant's opinions about several questions pulled directly from the bioethics survey (1a preserve the environment, 6c animal genes in a chicken, 6d human genes in a chicken, 12a gene manipulation cure fatal disease, 12b gene manipulation prevent fatal disease, 19a-e privacy rights). The transcript of the 13 recorded interviews of the groups science professor, science major undergraduate, and non-science major undergraduate were analyzed using MAXQDA (VERBI Software, 2019) upon completion. All of the interviews were member checked; in other words, the transcript of the interview was sent to the interviewee via email so that they could read it over and make any changes they deemed necessary before sending it back for analysis in this study.

Participants were asked to further explain their answer and reasoning behind select survey questions. The reasoning to these interview questions are summarized as follows (Tables 12-14):

Table 12: Professor Reasonings for Interview Questions

Question	Answer	Reasoning
6c- animal genes in chicken	Acceptable	• Just a gene, • not problematic, consider effects (positive) • similar processes already done
6d- human genes in chicken	Acceptable	• Weird but still ok • similar processes already done
	Unacceptable	• Other ways to achieve result • further research implications (2) • cannibalism
12a- change genes to cure fatal disease	Approve	• Just correcting an error • benefit others (4) • necessary for life • nothing to lose
12b- change genes to reduce risk of developing fatal disease	Approve	• Just correcting an error • benefit others (4) • necessary for life • nothing to lose
19a- should employer know about genetic disease	Yes	• Affect productivity, safety, and others
	No	• Just needs to know accommodation not disease • Discrimination concerns
19b- should insurer know about genetic disease	Yes	• N/A
	No	• Privacy • May not affect productivity • Avoid price increase
19c- should spouse or fiancé know about genetic disease	Yes	• Affect having children (2)
	No	• Your choice to tell them do not have to
19d- should immediate family know about genetic disease	Unsure	• May not affect them (2) • May affect them (2) • cause unnecessary worry
	No	• Your choice to tell them do not have to
19e- should gov. health organization know about genetic disease	Yes	• Benefits from research and knowledge gained (2)
	No	• Information use concerns, • privacy (2)
1c- should humans preserve environment	Agree	• Need clean water (3) • economic impact could be severe without • survival (3) • other species exist • human uses • we only have 1 earth

Table 13: Student Science Major Reasonings for Interview Answers

Question	Answer	Reasoning
6c- animal genes in chicken	Acceptable	• It is fine if we are transparent about what is in the chicken • consider effects (2) • similar processes already occur
	Neither	• is it safe • how will chicken be affected
	Unacceptable	• Don't mess with their fat levels they have the capability for a reason • chicken health
6d- human genes in chicken	Acceptable	• It is fine if we are transparent about what is in the chicken • consider effects
	Neither	• Cannibalism technicality • is it safe • how will chicken be affected
	Unacceptable	• Weird • genetic differences between species • lack of education on subject
12a- change genes to cure fatal disease	Approve	• Needs research • minimize impact (3) • consider effects (2) • necessary for survival • nothing to lose (2)
12b- change genes to reduce risk of developing fatal disease	Approve	• Needs research, minimize impact (3) • consider effects (2) • necessary for survival • nothing to lose (2)
19a- should employer know about genetic disease	Unsure	• Spread ability • your choice • may need accommodations • effect on productivity (2)
	No	• Family should know first • your choice • discrimination concerns • may not even affect work
19b- should insurer know about genetic disease	Unsure	• Could raise prices • rates may need to be adjusted • your choice • they deal with your medical information so they need it
	No	• Insurance should not be health based • they do not immediately need to know
19c- should spouse or fiancé know about genetic disease	Yes	• Support system (2) • children determination (2)
	No	• Your choice to tell them or not

19d- should immediate family know about genetic disease	Yes	• Support system • in case of emergency • others in family may have disease
	Unsure	• Could make you act different • death may be soon • family could be concerned • if you spend a lot of time with them
	No	• Your choice to tell them or not
19e- should gov. health organization know about disease	Unsure	• Information use concerns • spread ability • your choice (2) • contribute to research (3)
1c- should humans preserve environment	Agree	• We are part of environment • affects other species • resource limit (2) • beauty • human use • one earth • generation to make an impact • have proof of effects

Table 14: Student Non Major Reasonings for Interview Answers

Question	Answer	Reasoning
6c- animal genes in chicken	Acceptable	• Not problematic • similar processes already occur
	Unacceptable	• They are alive should not change them • vegetarian • chicken health
6d- human genes in chicken	Unacceptable	• Vegetarian • cannibalism (2) • Lack of education on subject (2) • weird (2) • chicken health, • genetic difference between species
12a- change genes to cure fatal disease	Approve	• Your choice • personal experience with this situation • minimize impact (2)
	Neither	• Consider risks • other factors may affect treatment
12b- change genes to reduce risk of developing fatal disease	Approve	• Your choice • personal experience with this situation • minimize impact (2)
19a- should employer know about genetic disease	No	• Discrimination concerns • may not affect work (2)
19b- should insurer know about genetic disease	No	• May not affect productivity • price increase (2) • scam

		• should not be health based
19c- should spouse or fiancé know about genetic disease	Yes	• Person closest to you know your secrets (3) • deciding to have children (3)
19d- should immediate family know about genetic disease	Yes	• In case of emergency • behavior may change • others in family may have disease
	No	• your choice to tell them or not
19e- should gov. health organization know about genetic disease	No	• Information use concerns, • may not affect productivity, • keep anonymous • your choice
1c-should humans preserve environment	Agree	• Resource limit (2) • recreation • fashion industry damage, • government help needed, • climate change evident (2) • human uses • proof of effects already seen (2)

Overall, Tables 12-14 show while there may be overlap in the answer to a question, the reasonings for the answer are extremely different. There were numerous reasonings stated by one person, but only a few reasonings given by 3 or more participants in each participant type group. A few patterns can be seen in these reasonings as well. For example, when regarding if human genes should be inserted into a chicken to make it less fatty, the professors seemed more likely to think about the consequences of such type of research becoming available while both student groups focused more on the "weird" feelings and feelings of cannibalism if they were to consume such a chicken. All participant types seemed to approve of question 12 (preserve the environment) with decreasing suffering and extending human life being common reasons. Question 19 (privacy rights) varied widely between both answers and reasonings. Student non majors were more likely to agree with each other (whether it be yes or no for each part) while the other participant types did not share 100% agreement with any part of question 19. Common reasonings included discrimination concerns, who the disease affects, child concerns, and the ability to choose to tell someone ("your choice"). Everyone in every group "agreed" with

question 1a of humans needing to preserve the environment. The reasons varied but some overlapped, such as resource limits, survival, need for clean water, climate change, and the current effects on the environment we are witnessing.

A summary and connectivity of the reasonings given in the interview for the selected survey questions are summarized in the figures 8 and 9 below:

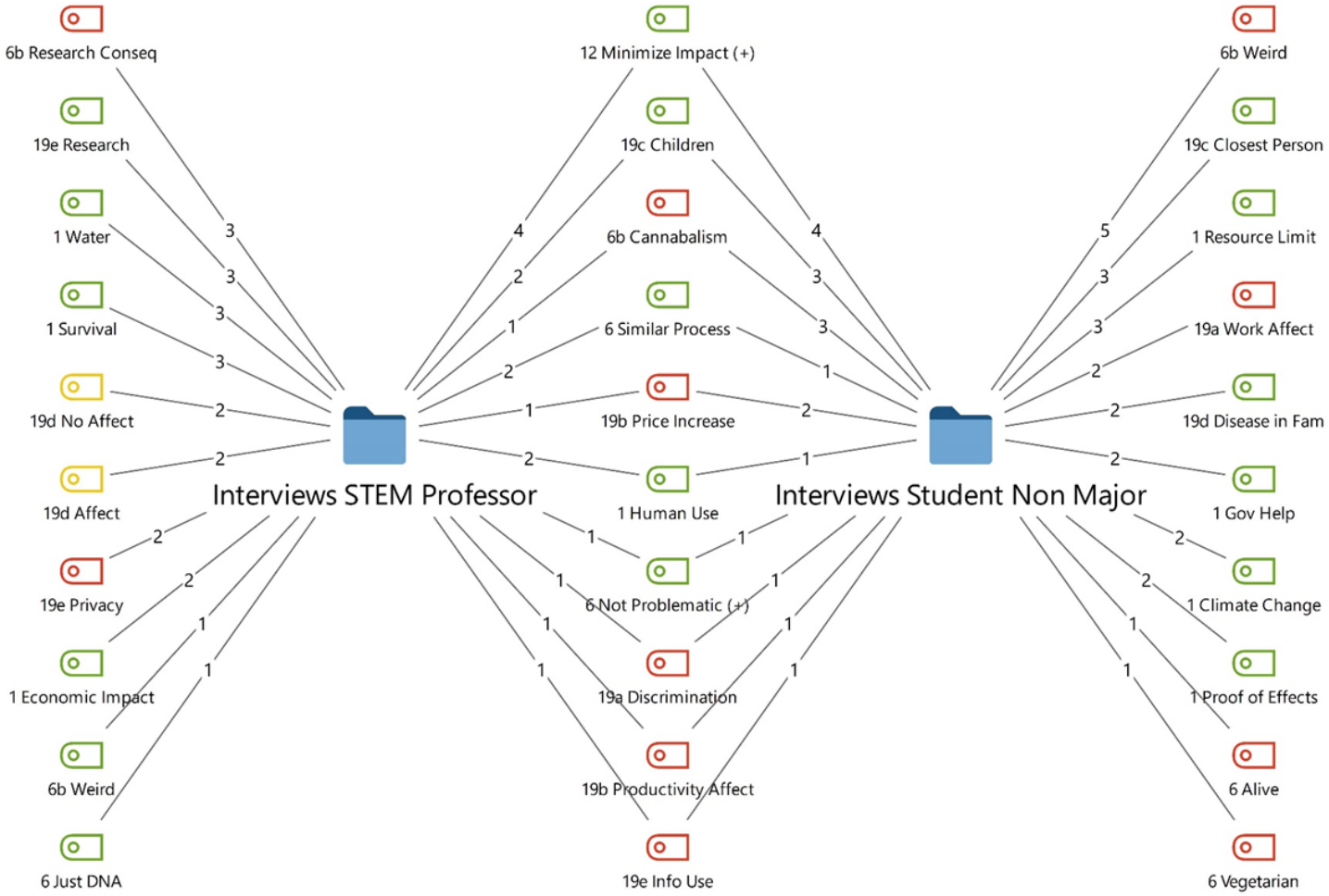

Figure 8: Most Common Interview Answers and Reasonings for Professors and Student Non Majors

*Numbers on the lines are the number of matching responses

**Numbers in front of the reasonings are the survey question number they apply to

***Red- Disagree/Disapprove, Yellow- Neither, Green- Agree/Approve

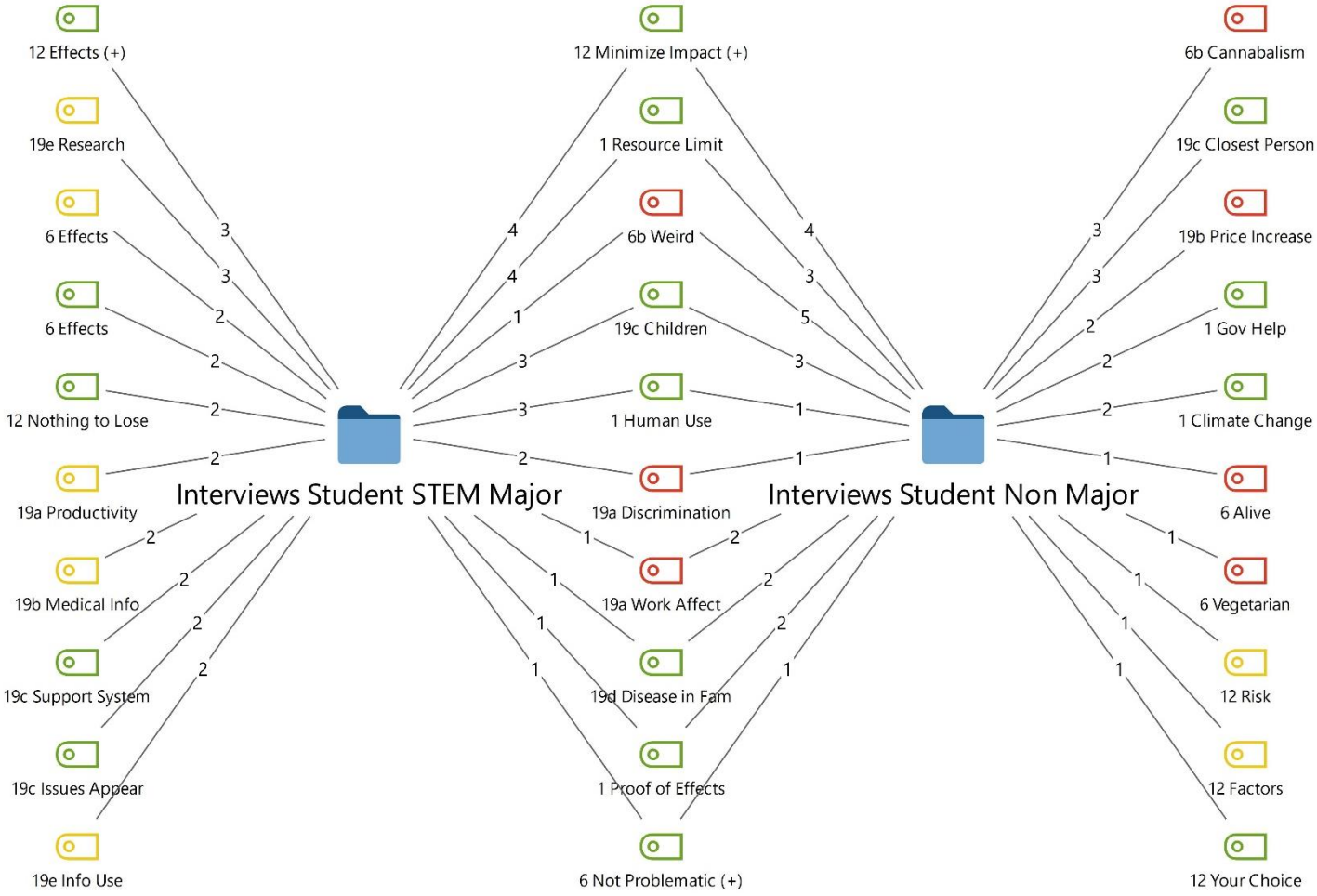

Figure 9: Most Common Interview Answers and Reasonings for Student Science Majors and Student Non Majors

*Numbers on the lines are the number of matching responses

**Numbers in front of the reasonings are the survey question number they apply to

***Red- Disagree/Disapprove, Yellow- Neither, Green- Agree/Approve

As seen in the figures 8 and 9 above, the most common reasoning of "minimizing impact" overlapped between all groups in question 12 (fixing genetic disease). Another common reasoning shared among all of the groups was the need for a spouse to know their partner's genetic disease in case it could be passed onto children (19c). Additionally, while everyone agreed the environment should be preserved by humans there was not a lot of overlap between participant reasoning besides "resource limits" which the undergraduate science major and undergraduate non science major students shared. While figures 8 and 9 showed the common overlaps they also show the most common answers for each separate category. Science professors tended to favor more scientific like reasoning, such as considering the research consequences of being able to add human genes to a chicken (6d) and having a government health organization know about a disease in order to facilitate research (19e). Science major students seem to favor weighing the effects of a bioethical action, such as the effects of curing a fatal disease (12) and the effects of manipulating chicken genes (6). Student non majors tended to favor more feelings based reasoning, such as the "weird" feeling of eating a chicken with human genes (6d) and the feeling of a spouse being your "closest person" so they should know everything about you, including genetic diseases (19c).

Ethical Approaches

It was evident in this study that several ethical approaches were taken when dealing with bioethical questions, and sometimes multiple approaches were used for the same question as found by the researcher classification method mentioned in chapter 3. For example, in question 19 a participant may have had the reasoning of "your choice" for telling an employer about a genetic disease (rights based approach) but also had the reasoning of "increasing rates" as a reason to not tell the insurer about a genetic disease (egotistical approach). Other times, an

answer cannot be classified into the approaches defined in this study at all (such as "weird" feelings and feelings of cannibalism in 6d). The ethical approaches identified in this study (see Appendix D for list and definitions) are summarized as follows (Table 15):

Table 15: Ethical Approach Frequency by Participant Type

Type	Approach	Frequency
Non Major Student	Utilitarianism	12
	Rights Based	9
	Egotistical	5
	Common Good	2
Professor	Utilitarianism	14
	Rights Based	4
	Common Good	4
	Egotistical	1
Science Major Student	Utilitarianism	16
	Rights Based	13
	Egotistical	6
	Common Good	3
	Duty Based	1
	Justice	1

The most common approach was utilitarianism for all participant types. Utilitarianism is the weighing of the benefits and harms of a decision. Common utilitarian answers included what were the risks to the chicken or the person consuming a chicken with human genes (Q6), what the benefits of fixing a fatal gene (Q12), discussing the risks of having children with a disease (Q19), and weighing the numerous benefits from the environment against the cons of not preserving it (Q1). Rights Based (where the rights of an individual are prioritized) was the second most common approach in all participant type groups, with the reasoning of "your choice" apparent throughout most questions in the interview. Interestingly enough, the common good approach (prioritize what is best for society as a whole instead of individually) was not frequent. The egotistical approach (what looks best for the individual making the decision) occurred more frequently in the students than in the professors. The most rare ethical approaches

were duty based (with the participant regarding the pressure to protect the environment after being told all their life they are the generation to fix it), and justice based (with regards to providing equal opportunity hiring for disabilities). Overall, all participant groups focused on ethical approaches around oneself or an individual (utilitarianism, rights based) while approaches of what is best for a whole group or society (common good, justice based) were rarely found.

Summary

The modified bioethics survey showed many significant relationships between several variables. Common variables with relationships were participant type and gender. Other variables include age and religion. The interview revealed unanimous agreement about the importance of protecting the environment and near unanimous agreement about fixing a fatal gene in humans. The interview also revealed a wide variety of reasonings for each topic and a variety of answers for topics about genetically modified organisms and privacy rights (question number 6 and 19). The ethical approach classification showed utilitarianism as the most common ethical approach for everyone despite group type, followed by the rights-based approach.

Chapter 5: Discussion and Conclusions

Conclusions

The modified bioethics survey showed many significant results, thus supporting the idea that variables such as experience and gender affected bioethical attitudes (Dehghani et al., 2015; Haude et al., 2017; Rajiah & Venaktaraman, 2019). The results showed that science professors, who are bound to have more scientific experiences than the undergraduate students, were more open minded about genetic modification endeavors. Non-major students appeared to be more apprehensive when regarding the bioethical scenarios than the professors. The results revealed females also typically were more apprehensive than males regarding the bioethical scenarios. Keeping the uneven sample distribution in mind, bioethical attitudes appeared to show significant relationships with the subjects' religion and age in this study as seen in previous studies (Haude et al., 2017; Raijiah & Venktaraman, 2019). This suggests that bioethical attitude and approach can be predicted according to select variables. This also signifies an approach to discussing bioethical questions. Science and religious leaders will all need to be involved in decision-making, along with the public whom the decisions will likely effect.

Decision-making is a complicated process that requires multiple approaches and reasonings, that sometimes may not even make logical sense (Mintzberg & Westley, 2001; Zhong et al., 2004). The bioethics interviews in this study revealed numerous reasonings behind answers, with only a few reasonings overlapping between participants. Most participants had several reasons per answer, and some even had similar reasonings yet different answers. The science professors seemed to dwell more on the consequences of the new scientific endeavors and were more likely to approve of genetic modification, for example, possibly suggesting their experience in the field has allowed a deeper understanding than students currently hold. Student

non majors were surprisingly more likely to agree with each other's answers, however they had a wide variety in their reasonings. The results from these interview showed that there are too many reasons to classify why someone selected an answer, and there are countless ways or reasons to end up with the same answer when making an ethical decision. This signifies the complex nature of ethical decision-making, especially in the sciences. It will be important for scientists as well as political and religious leaders to explore the data and to engage in these important discussions with themselves as well as with the public.

Ethical approaches are important to consider when analyzing bioethical decision-making. There are several categories of approaches, and these approaches may even lead to the same answer in the end (Bonde et al., 2013; Pasternak, 2012). According to Bonde et al. (2013) and Pasternak (2012), utilitarianism is the most common ethical approach. Results from this study support this finding, with utilitarianism being the top ethical approach in all participant type categories. This reflects the sample in this study has bioethical maturity- examining the benefits and costs of a decision before making it (Macer, 1994). The second most common approach found in this study was the rights based approach. This suggests the participants in this study valued human autonomy, since "it's your choice" was the most common reason given for this approach. Other approaches were more rare and a virtue based approach was not found to be present at all. However, this does not dismiss the importance of understanding a variety of viewpoints. Despite being rare, other approaches did occur in this small sample size so it can be assumed there are many more people with those approaches in a larger population.

The bioethics interview revealed possible reasoning behind answers in the interview. Questions 6c (animal gene in chicken), 6d (human gene in chicken), 19a (should employer know genetic disease), and 19e (should government health organization know genetic disease) were all

found to have significance relationships with predictor variables. Professors were more likely to find 6c (animal genes in a chicken) acceptable due to "it is just genes" and knowledge of previous scientific processes similar to using an animal gene to make a less fatty chicken. Student non science majors were more likely to find 6c (animal genes in a chicken) unacceptable due to apprehension of modification of animals, which could possibly be because of the lack of knowledge on the subject. Student science majors fell somewhere in between professors and student non majors, possibly because they are just starting to develop their knowledge on genetic modification. Males were also more likely to find 6c (animal genes in a chicken) acceptable than females. For 6d (human genes in a chicken), many factors were found significant. This could possibly be because of the nature of the question; it is more "controversial" since it involves using human genes in other species. Professors were more likely to find 6d (human genes in a chicken) more acceptable, with the common reasoning of "previous processes already occur". While half of the professors in the interviews did not find 6d (human genes in a chicken) acceptable, their reasoning focused more on the implications of future research and other methods to get the same result. This shows a more scientific approach to this question in comparison to the students. Males were also more likely to find 6d (human genes in a chicken) acceptable than females, while atheists and agnostics were more likely to approve 6d (human genes in a chicken) than Christians. Religion and gender affecting bioethical views has been found previously, so the fact they are seen in arguably the most controversial question asked in this study's interview is not surprising (Haude et al., 2017; Raijiah & Venktaraman, 2019).

For 19a (should employer know about genetic disease), professors were more likely to say it is none of an employer's business to know an employee's genetic disease information. Student non majors were more likely to reveal such information to an employer. While this trend

was not reflected in the interviews due to small sample size, overall reasoning for these answers were revealed. Those who said no were most concerned with discrimination and privacy issues. Those who said yes were most concerned about the safety of others and accommodations that may be needed. Acknowledging these different viewpoints would allow the situation to be addressed; in other words, satisfying those concerns could change somebody's thought process. Question 19e (should government health organizations know about genetic disease) was also found to have significance with participant type*age. Older participants were typically concerned with the benefits of revealing disease information with government health organizations. Younger participants as seen in the interviews may be more concerned with how the information is going to be used or what the government health organization did with the information. This could be remedied by better informing people on this area, thus changing such viewpoints through more education.

Overall, participant type and gender were the most common significant factors found in this study. This suggests experience plays a large role in bioethical decision-making. Keeping these factors along with others will allow better bioethics education and a more open-minded approach to bioethical scenarios. Acknowledging that there are numerous rationales for someone to use to make a decision and sometimes they may not be fully logical encourages a person to approach a bioethical situation with a well-rounded approach. The importance of a discussion of bioethics in current society cannot be overstated. Very little research has been conducted on this topic to date. While science majors were more informed than non-science majors, this trend may need to be reversed in the future. Discussions of bioethics and the sciences will need to be infused into liberal arts education as well in the future. In addition, science majors may need to

be provided opportunities to share their views with non-majors through campus-wide discussions.

Implications for Society

There is not a single scenario all people agreed on, so bioethics needs to be considered from every possible view. Even questions with a single popular answer (such as yes we should preserve the environment) had individuals who disagreed. However, individuals from all groups in this study and from all over the world in the study by Macer (1994) were commonly able to weigh the benefits and risks of a decision, even if they did not know much about it. The lack of the common good approach in this study implies that there may be a cultural aspect in bioethical decision-making. In this study, participants took approaches that focused on singular individuals (whether it be themselves or another); perhaps this is because of the "everyone for themselves" attitude that persists in the United States. Another country may have more of a common good approach since the widespread attitude may be collectivistic (i.e. what is best for society). Previous studies indicate that culture can impact the weight someone gives to a bioethical issue. Choe et al. (2013) found in their study that Korean nursing students weighed abortion as the most significant issue, likely because of the experiences with population control and government mandated abortions. Perhaps in another country where this experience never occurred the issue would be seen in a different light or not as serious.

Since bioethics affects many types of people, these people need to be included in the decision-making even if they are not scientists. Religious leaders, the public, people from different nationalities and background should all be involved in and assist with bioethical guideline making. This is especially important for bioethics on a global scale because different locations and experiences are sure to provide different views. Bioethics needs more discussion

for more viewpoints to come forward, more ideas, and more understanding on what affects reasonings behind decisions. This study also supports the need for bioethics (or at least general science) education, since those not involved with science or just starting their education were less likely be able to fully grasp some bioethical situations.

Limitations

There were a few limitations to this study. The COVID-19 pandemic possibly affected the response rate. It was also the reason the school semester was shortened (by one month) which gave the researcher less time to conduct and analyze the study. The study also had a large difference between participant types (it was not evenly distributed) potentially impacting equal sample size assumptions of ANOVA. This also occurred in regard to religion. A more even distribution of participant types and religions may yield a different statistical outcome. The study also occurred at one university. Other locations may have completely different results. Additionally, studies based on voluntary participation (which was used for the interview in this study) tend to attract people who feel strongly about the topic.

Future Research

This study reveals many opportunities for future research. For example, questions on more sensitive bioethical topics such as reproductive technology and euthanasia could be added to the survey and interview. More "controversial" topics will likely have more extreme views on many sides, thus allowing more insight on what affects bioethical decision-making. Future research could also include more follow-up interviews to hopefully gain a wider variety of viewpoints and reasonings, even if those views are uncommon, and to bring to the forefront more commonly shared reasonings. The interview questions could also be more targeted to determine

the prevalence of the common good approach, which would allow insight into the "individual vs society" cultural mindset. For example, asking a participant their opinion on mandatory vaccination would provide a look into the overall attitude for the society of that studied sample. Additionally, future research could include question checkers since the bioethical survey is so long. These questions could randomly be distributed among the survey and say, for example, "answer this question as strongly agree". These checkers would increase the accuracy and validity of the survey by ensuring someone is not selecting random answers. Validity could also be improved in future research by ensuring a larger sample and more even distribution of participants. Finally, this study could also be conducted at multiple universities in multiple disciplines to see if location or major correlates with bioethical views.

Reflection

I had many worries for this study in the beginning due to lack of structure. This is only my second time doing research with people, and my first time coming up with such research on my own. The original survey needed to be modified since it was not administered online. I was also worried that the COVID-19 pandemic would restrict the number of responses I received, but luckily I was still able to get a decent response rate, although the responses were unevenly distributed in some areas. I am surprised in the sample distribution since I did not expect more non science people to take this survey than science people. This is a pleasant surprise but I wish I could have ensured a more even distribution for the sake of the statistical analysis. While conducting interviews via video conferencing was a new experience for me, I found that it worked well. Additionally, I had a large learning curve for figuring out how to use several data analysis software packages, but with many video tutorials and research I was able to learn the basics fairly quickly. It is evident that moral and ethical reasoning affects bioethical decision-

making. Investigating other social factors such as these would be interesting. I hope I am able to continue this research in my career and further explore the factors affecting bioethical decisions.

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Appendix A- IRB Approval Letter

November 18, 2020

Ashley Lytle
Department of Biology
UNCP Campus

Title of Study: Factors Affecting Attitudes Towards Bioethics in the Sciences; IRB Protocol # 34-20

Dear Ms. Lytle:
The IRB has completed review of your protocol titled: Factors Affecting Attitudes Towards Bioethics in the Sciences and it is APPROVED.

Please note that if significant changes are made to the protocol, you must submit these changes to the IRB prior to their implementation in your study, as they may change the status of your review. Also, if any unanticipated or adverse events occur during this research, you must notify the IRB immediately.

Please include your protocol number (#34-20) on any future correspondence. This protocol expires in September 2023. If you should need to extend the research study beyond September 2023, please submit a new protocol to the IRB.

Due to the coronavirus, please be mindful of these additional points.

1. At the present time (i.e., July 2020), in-person research, with few exceptions, are not allowed on UNCP campus. I will inform researchers once in-person research can continue. However, researchers may still conduct virtual research during this time period.
2. If the coronavirus requires a change to your protocol, please send me these revisions.

Sincerely,

Erik C. Tracy, Ph.D.
Associate Professor of Psychology
IRB Chair

Appendix B- Interview Email

Good afternoon,

My name is Ashley Lytle and I am a UNCP graduate student conducting a study on what determines bioethical attitudes at UNCP. I am completing this study under the supervision of Dr. Rita Hagevik as part of my research for my Master's Thesis.

I would like to assess how students and professors make ethical decisions and what factors may affect these decisions. There are many situations where a science related ethical decision may be necessary. Here is a current bioethical situation example: when the COVID-19 vaccine is developed, should you get it right away? Should it be a requirement for students to get the vaccine in order to attend school? Who should receive the vaccine first? There are many things to think about when making those decisions!

The results of this study can be used to determine what misinformation is common and customize bioethics education/ training in the future.

This email is to ask for your voluntary participation in a 25 minute interview to discuss your reasoning for your answers in your bioethics survey. The interview will take place over WebEx. If you would like to participate, please email me (Ashley) at arl027@bravemail.uncp.edu to schedule a time that is convenient for you. A consent form will be sent to you to read over, ask questions, and electronically sign before the interview. This consent form must be read and signed before an interview can be scheduled.

Your personal information (name and email) will be kept confidential. Your name and email will not be associated with your survey results. This information will also not be reported in the interview analysis, so you will not be identifiable or connected to any data.

Thank you so much for your participation!

Regards,

Ashley Lytle

Appendix C- Interview Decline Email

Thank you for volunteering to be interviewed! Due to the high volume of volunteers, I will not be able to fit you into the interviewing sessions. However, I wanted to take the time to personally thank you for taking my survey and offering to interview. Your time is greatly appreciated! Thanks so much, if you have any questions feel free to contact me!

Regards, Ashley Lytle

Appendix D- Ethical Theory and Approaches

Decision-making in ethics is highly dependent on the process of ethical reasoning. Ethical reasoning is how an individual determines their decision on an ethical dilemma (Pasternak, 2012). The different ways an individual can "reason" out an ethics situation can be explained by ethical theories, which is the criteria an individual uses while evaluating (Bonde et al., 2013; Pasternak, 2012). Bonde et al. (2013) divided these theories in three main categories: Consequentialist (who's main concern is the consequences of actions), Non-Consequentialist (who's main concern is the intention of the person), and Agent-Centered (who's main concern is the overall ethical standing of the individual at the time of the dilemma). These theories have different approaches within them, listed below:

Consequentialist Theory

Approach	Description	Example
Utilitarian	"the good over harm" (Bonde et al., 2013; Pasternak, 2012)	For example, if an individual approaches the situation of gene therapy to eliminate the chance of a fatal disease gene, a utilitarian may reason the chance of a rare complication from the procedure does not outweigh absolute death from the fatal disease.
Egotistical	"what action brings the most good on myself" (Bonde et al., 2013; Pasternak, 2012)	For example, when debating if an insurance company should know about a genetic disease an egotistic individual may reason they should not tell the insurance company since the individual does not want their rates to increase.
Common Good	"what is beneficial to everyone" (Bonde et al., 2013)	For example, an individual may support mandatory vaccinations to protect those who cannot get them for medical reasons.

Non-Consequentialist Theory

Approach	Description	Example
Duty Based (Deontological)	"sense of duty to do the right thing; obligation" (Bonde et al., 2013; Pasternak, 2012)	For example, an employee may feel obligated to report their genetic disease to their boss since it is company policy.
Rights Based	"protection of the individual's (who is affected) rights/dignity" (Bonde et al., 2013; Pasternak, 2012)	For example, an individual may support gene therapy becoming widely available because it comes down to someone's personal choice to use it or not (the individual doesn't have to necessarily use it themselves!)
Justice (Fairness)	"can be applied to everyone; equality and impartiality is their guide" (Bonde et al., 2013; Pasternak, 2012)	For example, an individual may support funding for gene therapy access in low income areas since that would make the opportunity equal for everyone to take.

Agent Based Theory

Approach	Description	Example
Virtue	"action should be consistent with virtue; take into account of a person's history, not just one event" (Bonde et al., 2013)	For example, if someone harmed the environment by littering but they do not have a history of this an individual may support "no penalties" for the litter bug.

How does this relate to the current study?

These approaches can be applied when examining the reasoning behind the research study participant's answers in the interview. Since the participants were asked to make ethical decisions, they are likely applying one of these theories to their reasoning. Interview answers can be sorted into categories; patterns may be found with certain theories or approaches applying to certain decisions. This can be connected back to the survey to predict the approaches of other participants with similar answers.

Examining which approaches are most common may also assist the development of bioethics education. Using the most common approaches when teaching will make the lessons more relatable to a larger audience. It is also useful to know the less common approaches so that they may be addressed in education and used to help individuals learn to see the diversity of reasonings behind ethical decisions.

Appendix E- Student Survey Questions

Attitudes Towards Bioethics

Start of Block: Consent Message

University of North Carolina at Pembroke Consent to Participate in a Research Study Adult Participants IRB Study Number: UNCP IRB Contact Information: irb@uncp.edu 910-775-4512 **Consent Form Version Date:** 8/18/2020 **Title of Study:** Factors Affecting Attitudes Towards Bioethics in the Sciences **Principal Investigator Contact Information:** Ashley Lytle arl027@bravemail.uncp.edu 910-783-4296

Message to Participants- Welcome to the Attitudes Towards Bioethics 2020 survey. Bioethics is the interdisciplinary combination of scientific knowledge and morals (Ten Have, 2012). This survey of bioethics will take approximately 30 minutes to complete and all responses will be kept confidential. The questions will ask your feelings towards certain bioethical scenarios and your experiences with them. Here is an example of a current bioethical scenario: should students be required to get the COVID-19 vaccine in order to attend school? The decision(s) that are made about this scenario is a great illustration of ethical decision making. Participation The following survey will include bioethical situations for you to make decisions about. This information will be used to determine factors that affect ethical attitudes in the sciences. There are no right or wrong answers. Please answer the questions as honestly as possible. Participation is completely voluntary. You may withdraw your participation at any time for any reason, without penalty. Your information will not be shared at any time; results will only be reported in an aggregate form. Survey participants must be at least 18 years of age. If these questions become too mentally taxing at any time and you feel that you need additional help, please do not hesitate to contact the UNCP Student Health Services (shs@uncp.edu 910-521-6219) or the UNCP Counseling and Psychological Service (910-521-6786) for their services. Confidentiality If you complete the survey, you will have the option to put your name and email address at the end to be entered in a random drawing for a $10 Starbucks gift card. There will also be an option to provide a a name and email if you would like to participate in an interview. Your name and email address will not be used for any other reason than the drawing/interview contact. This information will not be reported or connected to your survey answers. This information will not be kept or used in the interview analysis. Entering the drawing and/or interview is voluntary; you do not have to enter to finish this survey. Benefits There are no direct benefits to you as a participant in this research study; however, this research will contribute to the knowledge of the factors that affect bioethical decisions and hopefully provoke further research in this area. This information along with further research could eventually be used to customize bioethics education training for both students and professors in the form of a course or workshops. This research will encourage bioethics education and thus help students become more bioethically informed in the future. Risks There are no risks to the participants

greater than what is experienced in everyday life. Risk is limited to breach of confidentiality. Steps will be taken to prevent this by using pseudonyms in the final analysis and by using an Electronic Gift Card (EGift Card) for the Starbucks drawing (thus, no other information besides the voluntary name and email provided will be needed). Names and emails will not be connected to any results in the study and will only be used for contact purposes only; this information will be destroyed after all necessary contact is complete. You may contact the principal investigator at any time with questions or concerns. Thank you for your participation! I have read the information provided above. I have asked all the questions I have at this time. I confirm that I am 18 years or older. I voluntarily agree to participate in this research study survey.

- ○ Yes I consent (1)
- ○ No I do not consent (2)

Skip To: End of Survey If University of North Carolina at Pembroke Consent to Participate in a Research Study Adult Partici... = No I do not consent

End of Block: Consent Message

Start of Block: Demographics General

What is your gender?

- ○ Female (1)
- ○ Male (2)
- ○ Transgender Female (3)
- ○ Transgender Male (4)
- ○ Gender Variant/Non-Conforming (5)
- ○ Other (6) _____
- ○ Prefer Not to Answer (7)

What is your age?

▼ 17 years or less (1) ... Prefer Not to Answer (9)

Skip To: End of Survey If What is your age? = 17 years or less

What is your ethnic origin? Choose all that apply.

- ☐ Caucasian (1)
- ☐ Asian (2)
- ☐ American Indian (3)
- ☐ African American (4)
- ☐ Latinx (5)
- ☐ Other ethnicity not listed above: (6) _____
- ☐ Prefer Not to Answer (7)

What is your current religion, if any?

- ○ Christian (1)
- ○ Muslim (2)
- ○ Buddhist (3)
- ○ Hindu (4)
- ○ Atheist (5)
- ○ Agnostic (6)
- ○ Other (7) _____
- ○ Prefer Not to Answer (8)

Is English your first language?

- ○ Yes (1)
- ○ No (2)
- ○ Prefer Not to Answer (3)

End of Block: Demographics General

Start of Block: Demographics Students

The following questions should be answered by undergraduate students only. If you are not an undergraduate student, please select the "I am not a student" option for the next question.

What is your student classification?

- ○ Freshman (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ I am not a student (5)

Skip To: End of Block If What is your student classification? = I am not a student

How often has bioethics come up in your courses so far?

- ○ Frequently (5 or more times) (1)
- ○ Occasionally (3-4 times) (2)
- ○ Rarely (1-2 times) (3)
- ○ Not at All (4)
- ○ Don't Know (5)
- ○ I am not a student (6)

Are you a science major in the departments of physics, geology, geography, biology, or chemistry?

- ○ I am a science major in the categories listed above (1)
- ○ I am NOT a science major in the categories listed above (2)

Skip To: End of Block If Are you a science major in the departments of phyiscs, geology, geography, biology, or chemistry? = I am NOT a science major in the categories listed above

What is your science major?

_____

End of Block: Demographics Students

Start of Block: Attitude Questions (Scale)

The following section has questions that asks for your opinion/experiences with ethical situations. Please select one answer on the scale that best correlates with your thoughts. Please answer honestly; there are no wrong answers.

Q1: To what extent do you agree or disagree with the following statements?	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. Science makes an important contribution to the quality of life. (1)	○	○	○	○	○
b. Most problems can be solved by applying more and better technology. (2)	○	○	○	○	○
c. The natural environment is valuable and humans should preserve it. (3)	○	○	○	○	○
d. Genetically modified plants and animals will help agriculture become less dependent on chemical pesticides. (4)	○	○	○	○	○
e. Students should be informed about the social issues associated with science and technology so that they can participate in contemporary debates. (A social issue is something that affects a large amount of citizens in society; for example, herd immunity is a scientific concept where if enough people in society are vaccinated/immune to a disease, those who cannot be vaccinated are still protected) (5)	○	○	○	○	○

f. A married couple can use a surrogate mother and in vitro fertilization if they cannot get pregnant themselves. (8)	○	○	○	○	○
g. Animals have rights that people should not violate. (9)	○	○	○	○	○

Q2: During the past 12 months how often have you...?	Always (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)	Don't Know (6)
a. Bought foods labeled as "pesticide free" (1)	○	○	○	○	○	○
b. Stopped buying a product because it caused environmental problems (2)	○	○	○	○	○	○
c. Contributed money or time to an environmental cause (3)	○	○	○	○	○	○
d. Changed your lifestyle in significant ways to protect the environment (4)	○	○	○	○	○	○
e. Stopped eating a certain food because of concerns over its safety (5)	○	○	○	○	○	○
f. Sorted out certain types of household waste (glass, papers, ...) for recycling (6)	○	○	○	○	○	○
g. Saved energy, for example, by using less hot water, by closing doors and windows in winter to save heat (7)	○	○	○	○	○	○

Q3: Do you have any worries about the impact of research or its applications of these scientific discoveries and developments? How much?

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
In vitro fertilization (1)	○	○	○	○	○
Computers (2)	○	○	○	○	○
Biotechnology (3)	○	○	○	○	○
Nuclear power (4)	○	○	○	○	○
Agricultural Pesticides (5)	○	○	○	○	○
Genetic engineering (6)	○	○	○	○	○

Q4: Overall do you think science and technology do more harm than good, more good than harm, or about the same of each?

- ○ More good (1)
- ○ Some good (2)
- ○ Same (3)
- ○ Some harm (4)
- ○ More harm (5)

Q5: Can you tell me how much you have heard or read about each of these subjects?

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
Agricultural Pesticides (1)	○	○	○	○	○
In vitro fertilization (2)	○	○	○	○	○
Computers (3)	○	○	○	○	○
Biotechnology (4)	○	○	○	○	○
Nuclear power (5)	○	○	○	○	○
AIDS (6)	○	○	○	○	○
Human gene therapy (7)	○	○	○	○	○
Genetic engineering (8)	○	○	○	○	○

Q6: How acceptable do you think the following statements or questions are?	Completely Acceptable (1)	Somewhat Acceptable (2)	Neither Acceptable nor Unacceptable (3)	Somewhat Unacceptable (4)	Completely Unacceptable (5)
Genes from most types of organisms are interchangeable. Would potatoes made more nutritious through biotechnology be acceptable or unacceptable to you if genes were added from another type of plant, such as corn? (1)	○	○	○	○	○
Would such potatoes be acceptable or unacceptable to you if the new genes came from an animal? (2)	○	○	○	○	○
Would chicken made less fatty through biotechnology be acceptable or unacceptable if genes were added to the chicken from another type of animal? (3)	○	○	○	○	○
Would such chicken be acceptable or unacceptable if the genes came from a human? (4)	○	○	○	○	○

Q7: If any of the following were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?

	Extremely Concerned (1)	Moderately Concerned (2)	Somewhat Concerned (3)	Slightly Concerned (4)	No Concerns (5)
Dairy products (1)	○	○	○	○	○
Vegetables (2)	○	○	○	○	○
Meat (3)	○	○	○	○	○
Medicines (4)	○	○	○	○	○

Q8: At what frequency does a genetic disease become high risk? Check one.

- ○ 50% (1)
- ○ 20% (2)
- ○ 10% (3)
- ○ 5% (4)
- ○ 2% (5)

Q9: How do you feel towards people that have the following genetic diseases?

	Very Positive (1)	Positive (2)	Neutral (3)	Negative (4)	Very Negative (5)	Don't Know (6)
Hemophilia (inability to produce blood clots properly) (1)	○	○	○	○	○	○
Muscular dystrophy (weaking and loss of muscle mass) (2)	○	○	○	○	○	○

Q10: How do you feel towards people with the following mental illnesses?

	Very Positive (1)	Positive (2)	Neutral (3)	Negative (4)	Very Negative (5)	Don't Know (6)
Mental depression (persistent feeling of sadness and dejection) (1)	○	○	○	○	○	○
Schizophrenia (causes abnormal interpretation of reality) (2)	○	○	○	○	○	○
Neurosis (chronic distress, but without hallucinations or delusions; constant worrying/fear) (3)	○	○	○	○	○	○

Q11: How willing are you to undergo the following procedures?

	Very Willing (1)	Somewhat Willing (2)	Neutral (3)	Somewhat Unwilling (4)	Very Unwilling (5)	Don't Know (6)
If tests showed that you were likely to get a serious or fatal genetic disease later in life, how willing would you be to undergo therapy to have those genes corrected before symptoms appear? (1)	○	○	○	○	○	○
If you had a child with a usually fatal genetic disease, how willing would you be to have the child undergo therapy to have those genes corrected? (2)	○	○	○	○	○	○

Q12: How do you feel about scientists changing the genetic makeup of human cells to:

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. Cure an usually fatal disease, such as cancer (1)	○	○	○	○	○
b. Reduce the risk of developing a fatal disease later in life (2)	○	○	○	○	○
c. Prevent children from inheriting an usually fatal disease (3)	○	○	○	○	○
d. Prevent children from inheriting a non-fatal disease, such as diabetes (4)	○	○	○	○	○
e. Improve the physical characteristics that children would inherit (5)	○	○	○	○	○
f. Improve the intelligence level that children would inherit (6)	○	○	○	○	○
g. Make people more ethical (7)	○	○	○	○	○
h. As an AIDS vaccine (8)	○	○	○	○	○

Q13: People who create something original can obtain financial reward for their efforts through patents and copyright. In your opinion, for which of the following should people be able to obtain patents and copyright?

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. New Inventions, such as consumer products (1)	○	○	○	○	○
b. Books and other information (2)	○	○	○	○	○
c. New plant varieties (3)	○	○	○	○	○
d. New animal breeds (4)	○	○	○	○	○
e. Genetic material extracted from plants and animals (5)	○	○	○	○	○
f. Genetic material extracted from humans (6)	○	○	○	○	○
g. A medical treatment or drug to cure AIDS (7)	○	○	○	○	○

Q14: If there was no direct risk to humans and only very remote risks to the environment, would you approve or disapprove of the environmental use of genetically engineered organisms designed to produce...?

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. Tomatoes with better taste (1)	○	○	○	○	○
b. Healthier meat (e.g. less fat) (2)	○	○	○	○	○
c. Larger sport fish (3)	○	○	○	○	○
d. Bacteria to clean up oil spills (4)	○	○	○	○	○
e. Disease resistant crops (5)	○	○	○	○	○
f. Cows which produce more milk (6)	○	○	○	○	○

Q15: Suppose that a number of groups made public statements about the benefits and risks of biotechnology products. Would you have trust or distrust in statements made by...?

	A lot of Trust (1)	Some Trust (2)	Neutral (3)	Some Distrust (4)	A lot of Distrust (5)
a. Government agencies (1)	○	○	○	○	○
b. Consumer agencies (2)	○	○	○	○	○
c. Companies making biotechnology products (3)	○	○	○	○	○
d. Environmental groups (4)	○	○	○	○	○
e. University professors (5)	○	○	○	○	○
f. Medical doctors (6)	○	○	○	○	○
g. Farmers or farm groups (7)	○	○	○	○	○
h. Dietitians or nutritionists (8)	○	○	○	○	○

End of Block: Attitude Questions (Scale)

Start of Block: Attitude Questions (Yes/No)

The following section has questions that asks for your opinion/experiences with ethical situations. Please answer to the best of your ability; some questions may require a short fill in answer. Please answer honestly; there are no wrong answers.

Q16: Before today, were you aware that genetically modified organisms, such as bacteria, plants and animals, are being used to produce food and medicines?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Q17: What are your thoughts on the following statements?

	Yes (1)	No (2)	Don't Know (3)
Some genetic diseases can be predicted in the fetus during the early stages of pregnancy. Do you think such tests should be available under government-funded Medicare? (1)	○	○	○
Would you want such a test during (your/your spouse's) pregnancy? (2)	○	○	○

Q18: Do you know anyone who has a genetic disease?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Skip To: Q19 If Q18: Do you know anyone who has a genetic disease? = No

Skip To: Q19 If Q18: Do you know anyone who has a genetic disease? = Don't Know

What genetic disease(s)? Answering this is optional.

- ○ List of genetic diseases: (1) _____
- ○ Prefer Not to Answer (2)

Q19: If someone is a carrier of a defective gene or has a genetic disease, who else besides that person deserves to know that information?

	Yes (1)	No (2)	Don't Know (3)
a. Employer (1)	○	○	○
b. Insurer (2)	○	○	○
c. Spouse or fiancé (3)	○	○	○
d. Other immediate family (4)	○	○	○
e. Government Health Organization (5)	○	○	○

Q20: If someone has HIV (the AIDS virus), who else besides that person deserves to know that information?

	Yes (1)	No (2)	Don't Know (3)
a. Employer (1)	○	○	○
b. Insurer (2)	○	○	○
c. Spouse or fiancé (3)	○	○	○
d. Other immediate family (4)	○	○	○
e. Government Health Organization (5)	○	○	○

Q21: Do you know anyone who has, or has had, a mental illness?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Skip To: Q22 If Q21: Do you know anyone who has, or has had, a mental illness? = No
Skip To: Q22 If Q21: Do you know anyone who has, or has had, a mental illness? = Don't Know

What mental illness(es)? Answering this is optional.

- ○ List of mental illnesses: (1) _____
- ○ Prefer Not to Answer (2)

Q22: Will you please express freely, in sentences, the images which come to mind when you hear the word "life", and/or any ideas you have on "life" or "living".

_____

_____

_____

_____

_____

End of Block: Attitude Questions (Yes/No)

Start of Block: Block 7

Would you like to further discuss/elaborate on your answers to assist the research study by volunteering for a 30 minute virtual interview with the principal investigator? This is completely optional. All of your information will be kept confidential. Your name and email will not be associated with this survey, nor will it be reported in the data analysis of the interview; it will be used for contact purposes only. If you would like to volunteer, select "yes" and you will be asked to leave your name and email. If you would not like to volunteer, select "no" and you will be sent to the next question.

- ○ Yes, I would like to volunteer for a follow up interview (1)
- ○ No, I would not like to volunteer for a follow up interview (2)

Skip To: End of Block If Would you like to further discuss/elaborate on your answers to assist the research study by volun... = No, I would not like to volunteer for a follow up interview

Thank you for volunteering! What is your name?

_____

What is your email address? The principal investigator will contact you at this email with more information shortly.

_____

End of Block: Block 7

Start of Block: Block 6

If you would like to be entered into a random drawing for a $10 Starbucks gift card, please enter the information below. Your name and email will not be associated with this survey; it will be used for contact purposes only. If you do not want to enter, select "no" and you will be taken to the end of the survey.

Would you like to enter the drawing for a Starbucks gift card? You will be asked to enter your name and email. If you select no, you will be taken to the end of the survey.

- ○ Yes, I would like to enter (1)
- ○ No, I would not like to enter (2)

Skip To: End of Survey If Would you like to enter the drawing for a Starbucks gift card? You will be asked to enter your na... = No, I would not like to enter

What is your name?

_____

What is your email address?

_____

End of Block: Block 6

Appendix F- Teacher Survey Questions

Attitudes Towards Bioethics

Start of Block: Consent Message

University of North Carolina at Pembroke Consent to Participate in a Research Study Adult Participants IRB Study Number: UNCP IRB Contact Information: irb@uncp.edu 910-775-4512 **Consent Form Version Date:** 8/18/2020 **Title of Study:** Factors Affecting Attitudes Towards Bioethics in the Sciences **Principal Investigator Contact Information:** Ashley Lytle arl027@bravemail.uncp.edu 910-783-4296
Message to Participants- Welcome to the Attitudes Towards Bioethics 2020 survey. Bioethics is the interdisciplinary combination of scientific knowledge and morals (Ten Have, 2012). This survey of bioethics will take approximately 30 minutes to complete and all responses will be kept confidential. The questions will ask your feelings towards certain bioethical scenarios and your experiences with them. Here is an example of a current bioethical scenario: should students be required to get the COVID-19 vaccine in order to attend school? The decision(s) that are made about this scenario is a great illustration of ethical decision making. Participation The following survey will include bioethical situations for you to make decisions about. This information will be used to determine factors that affect ethical attitudes in the sciences. There are no right or wrong answers. Please answer the questions as honestly as possible. Participation is completely voluntary. You may withdraw your participation at any time for any reason, without penalty. Your information will not be shared at any time; results will only be reported in an aggregate form. Survey participants must be at least 18 years of age. If these questions become too mentally taxing at any time and you feel that you need additional help, please do not hesitate to contact the UNCP Student Health Services (shs@uncp.edu 910-521-6219) or the UNCP Counseling and Psychological Service (910-521-6786) for their services. Confidentiality If you complete the survey, you will have the option to put your name and email address at the end to be entered in a random drawing for a $10 Starbucks gift card. There will also be an option to provide a name and email if you would like to participate in an interview. Your name and email address will not be used for any other reason than the drawing/interview contact. This information will not be reported or connected to your survey answers. This information will not be kept or used in the interview analysis. Entering the drawing and/or interview is voluntary; you do not have to enter to finish this survey. Benefits There are no direct benefits to you as a participant in this research study; however, this research will contribute to the knowledge of the factors that affect bioethical decisions and hopefully provoke further research in this area. This information along with further research could eventually be used to customize bioethics education training for both students and professors in the form of a course or workshops. This research will encourage bioethics education and thus help students become more bioethically informed in the future. Risks There are no risks to the participants greater than what is experienced in everyday life. Risk is limited to breach of confidentiality.

Steps will be taken to prevent this by using pseudonyms in the final analysis and by using an Electronic Gift Card (EGift Card) for the Starbucks drawing (thus, no other information besides the voluntary name and email provided will be needed). Names and emails will not be connected to any results in the study and will only be used for contact purposes only; this information will be destroyed after all necessary contact is complete. You may contact the principal investigator at any time with questions or concerns. Thank you for your participation! I have read the information provided above. I have asked all the questions I have at this time. I confirm that I am 18 years or older. I voluntarily agree to participate in this research study survey.

- ○ Yes I consent (1)
- ○ No I do not consent (2)

End of Block: Consent Message

Start of Block: Demographics General

What is your gender?

- ○ Female (1)
- ○ Male (2)
- ○ Transgender Female (3)
- ○ Transgender Male (4)
- ○ Gender Variant/Non-Conforming (5)
- ○ Other (6) _____
- ○ Prefer Not to Answer (7)

What is your age?

▼ 17 years or less (1) ... Prefer Not to Answer (9)

Skip To: End of Survey If What is your age? = 17 years or less

What is your ethnic origin? Choose all that apply.

- ☐ Caucasian (1)
- ☐ Asian (2)
- ☐ American Indian (3)
- ☐ African American (4)
- ☐ Latinx (5)
- ☐ Other ethnicity not listed above: (6) _____
- ☐ Prefer Not to Answer (7)

What is your current religion, if any?

- Christian (1)
- Muslim (2)
- Buddhist (3)
- Hindu (4)
- Atheist (5)
- Agnostic (6)
- Other (7) _____
- Prefer Not to Answer (8)

Is English your first language?

- Yes (1)
- No (2)
- Prefer Not to Answer (3)

End of Block: Demographics General

Start of Block: Demographics Teachers

The following questions should be answered by professors/teachers only. If you are not a professor or teacher, please select the "I am not an instructor" option for the next question.

What is your rank?

- ○ Adjunct Professor (1)
- ○ Assistant Professor (2)
- ○ Associate Professor (3)
- ○ Full Professor (4)
- ○ Other (5) _____
- ○ I am not an instructor (6)

Skip To: End of Block If What is your rank? = I am not an instructor

What subject do you teach or specialize in? Select all that apply.

- ☐ Biology (1)
- ☐ Chemistry (2)
- ☐ Physics (3)
- ☐ Biomedical Sciences (4)
- ☐ Biotechnology (5)
- ☐ Environmental Sciences (6)
- ☐ Other (7) _____
- ☐ I am not an instructor (8)

How many years of teaching experience (college level) do you have?

▼ 1-5 years (1) ... I am not an instructor (10)

End of Block: Demographics Teachers

Start of Block: Attitude Questions (Scale)

The following section has questions that asks for your opinion/experiences with ethical situations. Please select one answer on the scale that best correlates with your thoughts. Please answer honestly; there are no wrong answers.

Q1: To what extent do you agree or disagree with the following statements?	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
a. Science makes an important contribution to the quality of life. (1)	○	○	○	○	○
b. Most problems can be solved by applying more and better technology. (2)	○	○	○	○	○
c. The natural environment is valuable and humans should preserve it. (3)	○	○	○	○	○
d. Genetically modified plants and animals will help agriculture become less dependent on chemical pesticides. (4)	○	○	○	○	○
e. Students should be informed about the social issues associated with science and technology so that they can participate in contemporary debates. (A social issue is something that affects a large amount of citizens in society; for example, herd immunity is a scientific concept where if enough people in society are vaccinated/immune to a disease, those who cannot be vaccinated are still protected) (5)	○	○	○	○	○

f. A married couple can use a surrogate mother and in vitro fertilization if they cannot get pregnant themselves. (8)	○	○	○	○	○
g. Animals have rights that people should not violate. (9)	○	○	○	○	○

Q2: During the past 12 months how often have you...?	Always (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)	Don't Know (6)
a. Bought foods labeled as "pesticide free" (1)	○	○	○	○	○	○
b. Stopped buying a product because it caused environmental problems (2)	○	○	○	○	○	○
c. Contributed money or time to an environmental cause (3)	○	○	○	○	○	○
d. Changed your lifestyle in significant ways to protect the environment (4)	○	○	○	○	○	○
e. Stopped eating a certain food because of concerns over its safety (5)	○	○	○	○	○	○
f. Sorted out certain types of household waste (glass, papers, ...) for recycling (6)	○	○	○	○	○	○
g. Saved energy, for example, by using less hot water, by closing doors and windows in winter to save heat (7)	○	○	○	○	○	○

Q3: Do you have any worries about the impact of research or its applications of these scientific discoveries and developments? How much?

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
In vitro fertilization (1)	○	○	○	○	○
Computers (2)	○	○	○	○	○
Biotechnology (3)	○	○	○	○	○
Nuclear power (4)	○	○	○	○	○
Agricultural Pesticides (5)	○	○	○	○	○
Genetic engineering (6)	○	○	○	○	○

Q4: Overall do you think science and technology do more harm than good, more good than harm, or about the same of each?

- ○ More good (1)
- ○ Some good (2)
- ○ Same (3)
- ○ Some harm (4)
- ○ More harm (5)

Q5: Can you tell me how much you have heard or read about each of these subjects?

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
Agricultural Pesticides (1)	○	○	○	○	○
In vitro fertilization (2)	○	○	○	○	○
Computers (3)	○	○	○	○	○
Biotechnology (4)	○	○	○	○	○
Nuclear power (5)	○	○	○	○	○
AIDS (6)	○	○	○	○	○
Human gene therapy (7)	○	○	○	○	○
Genetic engineering (8)	○	○	○	○	○

Q6: How acceptable do you think the following statements or questions are?	Completely Acceptable (1)	Somewhat Acceptable (2)	Neither Acceptable nor Unacceptable (3)	Somewhat Unacceptable (4)	Completely Unacceptable (5)
Genes from most types of organisms are interchangeable. Would potatoes made more nutritious through biotechnology be acceptable or unacceptable to you if genes were added from another type of plant, such as corn? (1)	○	○	○	○	○
Would such potatoes be acceptable or unacceptable to you if the new genes came from an animal? (2)	○	○	○	○	○
Would chicken made less fatty through biotechnology be acceptable or unacceptable if genes were added to the chicken from another type of animal? (3)	○	○	○	○	○
Would such chicken be acceptable or unacceptable if the genes came from a human? (4)	○	○	○	○	○

Q7: If any of the following were to be produced from genetically modified organisms (an organism who has had their genetics altered by genetic engineering), would you have any concerns about using them? How much?

	Extremely Concerned (1)	Moderately Concerned (2)	Somewhat Concerned (3)	Slightly Concerned (4)	No Concerns (5)
Dairy products (1)	○	○	○	○	○
Vegetables (2)	○	○	○	○	○
Meat (3)	○	○	○	○	○
Medicines (4)	○	○	○	○	○

Q8: At what frequency does a genetic disease become high risk? Check one.

- ○ 50% (1)
- ○ 20% (2)
- ○ 10% (3)
- ○ 5% (4)
- ○ 2% (5)

Q9: How do you feel towards people that have the following genetic diseases?

	Very Positive (1)	Positive (2)	Neutral (3)	Negative (4)	Very Negative (5)	Don't Know (6)
Hemophilia (inability to produce blood clots properly) (1)	○	○	○	○	○	○
Muscular dystrophy (weaking and loss of muscle mass) (2)	○	○	○	○	○	○

Q10: How do you feel towards people with the following mental illnesses?

	Very Positive (1)	Positive (2)	Neutral (3)	Negative (4)	Very Negative (5)	Don't Know (6)
Mental depression (persistent feeling of sadness and dejection) (1)	○	○	○	○	○	○
Schizophrenia (causes abnormal interpretation of reality) (2)	○	○	○	○	○	○
Neurosis (chronic distress, but without hallucinations or delusions; constant worrying/fear) (3)	○	○	○	○	○	○

Q11: How willing are you to undergo the following procedures?

	Very Willing (1)	Somewhat Willing (2)	Neutral (3)	Somewhat Unwilling (4)	Very Unwilling (5)	Don't Know (6)
If tests showed that you were likely to get a serious or fatal genetic disease later in life, how willing would you be to undergo therapy to have those genes corrected before symptoms appear? (1)	○	○	○	○	○	○
If you had a child with a usually fatal genetic disease, how willing would you be to have the child undergo therapy to have those genes corrected? (2)	○	○	○	○	○	○

Q12: How do you feel about scientists changing the genetic makeup of human cells to:

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. Cure an usually fatal disease, such as cancer (1)	○	○	○	○	○
b. Reduce the risk of developing a fatal disease later in life (2)	○	○	○	○	○
c. Prevent children from inheriting an usually fatal disease (3)	○	○	○	○	○
d. Prevent children from inheriting a non-fatal disease, such as diabetes (4)	○	○	○	○	○
e. Improve the physical characteristics that children would inherit (5)	○	○	○	○	○
f. Improve the intelligence level that children would inherit (6)	○	○	○	○	○
g. Make people more ethical (7)	○	○	○	○	○
h. As an AIDS vaccine (8)	○	○	○	○	○

Q13: People who create something original can obtain financial reward for their efforts through patents and copyright. In your opinion, for which of the following should people be able to obtain patents and copyright?

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. New Inventions, such as consumer products (1)	○	○	○	○	○
b. Books and other information (2)	○	○	○	○	○
c. New plant varieties (3)	○	○	○	○	○
d. New animal breeds (4)	○	○	○	○	○
e. Genetic material extracted from plants and animals (5)	○	○	○	○	○
f. Genetic material extracted from humans (6)	○	○	○	○	○
g. A medical treatment or drug to cure AIDS (7)	○	○	○	○	○

Q14: If there was no direct risk to humans and only very remote risks to the environment, would you approve or disapprove of the environmental use of genetically engineered organisms designed to produce...?

	Strongly Approve (1)	Somewhat Approve (2)	Neutral (3)	Somewhat Disapprove (4)	Strongly Disapprove (5)
a. Tomatoes with better taste (1)	○	○	○	○	○
b. Healthier meat (e.g. less fat) (2)	○	○	○	○	○
c. Larger sport fish (3)	○	○	○	○	○
d. Bacteria to clean up oil spills (4)	○	○	○	○	○
e. Disease resistant crops (5)	○	○	○	○	○
f. Cows which produce more milk (6)	○	○	○	○	○

Q15: Suppose that a number of groups made public statements about the benefits and risks of biotechnology products. Would you have trust or distrust in statements made by...?

	A lot of Trust (1)	Some Trust (2)	Neutral (3)	Some Distrust (4)	A lot of Distrust (5)
a. Government agencies (1)	○	○	○	○	○
b. Consumer agencies (2)	○	○	○	○	○
c. Companies making biotechnology products (3)	○	○	○	○	○
d. Environmental groups (4)	○	○	○	○	○
e. University professors (5)	○	○	○	○	○
f. Medical doctors (6)	○	○	○	○	○
g. Farmers or farm groups (7)	○	○	○	○	○
h. Dietitians or nutritionists (8)	○	○	○	○	○

End of Block: Attitude Questions (Scale)

Start of Block: Attitude Questions (Yes/No)

The following section has questions that asks for your opinion/experiences with ethical situations. Please answer to the best of your ability; some questions may require a short fill in answer. Please answer honestly; there are no wrong answers.

Q16: Before today, were you aware that genetically modified organisms, such as bacteria, plants and animals, are being used to produce food and medicines?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Q17: What are your thoughts on the following statements?

	Yes (1)	No (2)	Don't Know (3)
Some genetic diseases can be predicted in the fetus during the early stages of pregnancy. Do you think such tests should be available under government-funded Medicare? (1)	○	○	○
Would you want such a test during (your/your spouse's) pregnancy? (2)	○	○	○

Q18: Do you know anyone who has a genetic disease?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Skip To: Q19 If Q18: Do you know anyone who has a genetic disease? = No

Skip To: Q19 If Q18: Do you know anyone who has a genetic disease? = Don't Know

What genetic disease(s)? Answering this is optional.

- ○ List of genetic diseases: (1) _____
- ○ Prefer Not to Answer (2)

Q19: If someone is a carrier of a defective gene or has a genetic disease, who else besides that person deserves to know that information?

	Yes (1)	No (2)	Don't Know (3)
a. Employer (1)	○	○	○
b. Insurer (2)	○	○	○
c. Spouse or fiancé (3)	○	○	○
d. Other immediate family (4)	○	○	○
e. Government Health Organization (5)	○	○	○

Q20: If someone has HIV (the AIDS virus), who else besides that person deserves to know that information?

	Yes (1)	No (2)	Don't Know (3)
a. Employer (1)	○	○	○
b. Insurer (2)	○	○	○
c. Spouse or fiancé (3)	○	○	○
d. Other immediate family (4)	○	○	○
e. Government Health Organization (5)	○	○	○

Q21: Do you know anyone who has, or has had, a mental illness?

- ○ Yes (1)
- ○ No (2)
- ○ Don't Know (3)

Skip To: Q22 If Q21: Do you know anyone who has, or has had, a mental illness? = No
Skip To: Q22 If Q21: Do you know anyone who has, or has had, a mental illness? = Don't Know

What mental illness(es)? Answering this is optional.

- ○ List of mental illnesses: (1) _____
- ○ Prefer Not to Answer (2)

Q22: Will you please express freely, in sentences, the images which come to mind when you hear the word "life", and/or any ideas you have on "life" or "living".

_____

_____

_____

_____

_____

End of Block: Attitude Questions (Yes/No)

Start of Block: Block 7

Would you like to further discuss/elaborate on your answers to assist the research study by volunteering for a 30 minute virtual interview with the principal investigator? This is completely optional. All of your information will be kept confidential. Your name and email will not be associated with this survey, nor will it be reported in the data analysis of the interview; it will be used for contact purposes only. If you would like to volunteer, select "yes" and you will be asked to leave your name and email. If you would not like to volunteer, select "no" and you will be sent to the next question.

- ○ Yes, I would like to volunteer for a follow up interview (1)
- ○ No, I would not like to volunteer for a follow up interview (2)

Skip To: End of Block If Would you like to further discuss/elaborate on your answers to assist the research study by volun... = No, I would not like to volunteer for a follow up interview

Thank you for volunteering! What is your name?

_____

What is your email address? The principal investigator will contact you at this email with more information shortly.

_____

End of Block: Block 7

Start of Block: Block 6

If you would like to be entered into a random drawing for a $10 Starbucks gift card, please enter the information below. Your name and email will not be associated with this survey; it will be used for contact purposes only. If you do not want to enter, select "no" and you will be taken to the end of the survey.

Would you like to enter the drawing for a Starbucks gift card? You will be asked to enter your name and email. If you select no, you will be taken to the end of the survey.

- ○ Yes, I would like to enter (1)
- ○ No, I would not like to enter (2)

Skip To: End of Survey If Would you like to enter the drawing for a Starbucks gift card? You will be asked to enter your na... = No, I would not like to enter

What is your name?

_____

What is your email address?

_____

End of Block: Block 6

Appendix G- Survey Email

Survey Recruitment Email

Good afternoon BraveNation,

My name is Ashley Lytle and I am a UNCP graduate student conducting a study on what determines bioethical attitudes at UNCP. I am completing this study under the supervision of Dr. Rita Hagevik as part of my research for my Master's Thesis.

I would like to assess how students and professors make ethical decisions and what factors may affect these decisions. Bioethics is the interdisciplinary combination of scientific knowledge and morals (Ten Have, 2012). There are many situations where a science related ethical decision may be necessary. Here is a current bioethical situation example: when the COVID-19 vaccine is developed, should you get it right away? Should it be a requirement for students to get the vaccine in order to attend school? Who should receive the vaccine first? There are many things to think about when making those decisions!

The results of this study can be used to determine what misinformation is common and customize bioethics education/ training in the future. The results will also contribute to the knowledge about the factors affecting ethical decisions. This survey is based on the International Survey for Bioethics.

Participation is completely voluntary, and the survey should take approximately 30 minutes. Those who do complete the survey will have a chance at the end to enter their name and email into a random drawing for one of ten $10 Starbucks gift cards! You will also have the chance to leave your name and email for a voluntary follow up interview. The survey otherwise is

completely anonymous and it is not required that you enter the drawing/interview in order to complete the survey. This information will not be linked to survey results.

Please complete the survey by clicking the following link:

https://uncp.co1.qualtrics.com/jfe/form/SV_exlL2l3sLHqwRFP

If you have any questions or difficulties with the survey, please contact me (Ashley Lytle) at arl027@bravemail.uncp.edu.

Thank you very much for your participation!

Regards, Ashley Lytle

Survey Reminder Email

Good afternoon BraveNation,

This is a reminder email to please consider completing the UNCP bioethics survey. If you already have, please disregard this email!

My name is Ashley Lytle and I am a UNCP graduate student conducting a study on what determines bioethical attitudes at UNCP. I am completing this study under the supervision of Dr. Rita Hagevik as part of my research for my Master's Thesis.

I would like to assess how students and professors make ethical decisions and what factors may affect these decisions. Bioethics is the interdisciplinary combination of scientific knowledge and

morals (Ten Have, 2012). There are many situations where a science related ethical decision may be necessary. Here is a current bioethical situation example: when the COVID-19 vaccine is developed, should you get it right away? Should it be a requirement for students to get the vaccine in order to attend school? Who should receive the vaccine first? There are many things to think about when making those decisions!

The results of this study can be used to determine what misinformation is common and customize bioethics education/ training in the future. This survey is based on the International Survey for Bioethics.

Participation is completely voluntary and the survey should take approximately 30 minutes. Those who do complete the survey will have a chance at the end to enter their name and email into a random drawing for one of ten $10 Starbucks gift cards! The survey otherwise is completely anonymous and it is not required that you enter the drawing in order to complete the survey. This information will not be linked to survey results.

Please complete the survey by clicking the following link:

https://uncp.co1.qualtrics.com/jfe/form/SV_exlL2l3sLHqwRFP

If you have any questions or difficulties with the survey, please contact me (Ashley Lytle) at arl027@bravemail.uncp.edu.

Thank you very much for your participation!

Regards, Ashley Lytle

Appendix H- Survey Consent

University of North Carolina at Pembroke

Consent to Participate in a Research Study

Adult Participants

IRB Study Number:

UNCP IRB Contact Information: irb@uncp.edu 910-775-4512

Consent Form Version Date: 8/18/2020

Title of Study: Factors Affecting Attitudes Towards Bioethics in the Sciences

Principal Investigator Contact Information: Ashley Lytle arl027@bravemail.uncp.edu 910-783-4296

Message to Participants-

Welcome to the Attitudes Towards Bioethics 2020 survey. Bioethics is the interdisciplinary combination of scientific knowledge and morals (Ten Have, 2012). This survey of bioethics will take approximately 30 minutes to complete and all responses will be kept confidential. The questions will ask your feelings towards certain bioethical scenarios and your experiences with them. Here is an example of a current bioethical scenario: should students be required to get the COVID-19 vaccine in order to attend school? The decision(s) that are made about this scenario is a great illustration of ethical decision making.

Participation

The following survey will include bioethical situations for you to make decisions about. This information will be used to determine factors that affect ethical attitudes in the sciences. There are no right or wrong answers. Please answer the questions as honestly as possible. Participation is completely voluntary. You may withdraw your participation at any time for any reason, without penalty. Your information will not be shared at any time; results will only be reported in an aggregate form.

Survey participants must be at least 18 years of age.

If these questions become too mentally taxing at any time and you feel that you need additional help, please do not hesitate to contact the UNCP Student Health Services (shs@uncp.edu 910-521-6219) or the UNCP Counseling and Psychological Service (910-521-6786) for their services.

Confidentiality

If you complete the survey, you will have the option to put your name and email address at the end to be entered in a random drawing for a $10 Starbucks gift card. There will also be an option to provide a name and email if you would like to participate in an interview. Your name and email address will not be used for any other reason than the drawing/interview contact. This information will not be reported or connected to your survey answers. This information will not be kept or used in the interview analysis. Entering the drawing and/or interview is voluntary; you do not have to enter to finish this survey.

Benefits

There are no direct benefits to you as a participant in this research study; however, this research will contribute to the knowledge of the factors that affect bioethical decisions and hopefully provoke further research in this area. This information along with further research could eventually be used to customize bioethics education training for both students and professors in the form of a course or workshops. This research will encourage bioethics education and thus help students become more bioethically informed in the future.

Risks

There are no risks to the participants greater than what is experienced in everyday life. Risk is limited to breach of confidentiality. Steps will be taken to prevent this by using pseudonyms in the final analysis and by using an Electronic Gift Card (EGift Card) for the Starbucks drawing (thus, no other information besides the voluntary name and email provided will be needed). Names and emails will not be connected to any results in the study and will only be used for contact purposes only; this information will be destroyed after all necessary contact is complete.

You may contact the principal investigator at any time with questions or concerns.

Thank you for your participation!

I have read the information provided above. I have asked all the questions I have at this time. I confirm that I am 18 years or older. I voluntarily agree to participate in this research study survey.

__ Yes I Consent

__ No I do not Consent

Appendix I- Interview Consent

University of North Carolina at Pembroke

Consent to Participate in a Research Study

Adult Participants

IRB Study Number: (#34-20)

UNCP IRB Contact Information: irb@uncp.edu 910-775-4512

Consent Form Version Date: 8/18/2020

Title of Study: Factors Affecting Attitudes Towards Bioethics in the Sciences

Principal Investigator Contact Information: Ashley Lytle arl027@bravemail.uncp.edu 910-783-4296

Message to Participants-

Thank you for considering participation in the bioethics attitude interview. This interview will take approximately 25 minutes to complete and all responses will be kept confidential. The questions will divulge into your reasoning and thoughts behind a few of your International Bioethics Survey answers. This information will be used to help determine factors that affect ethical attitudes in the sciences. The information will also be used to analyze bioethical approaches and ethical decision theories.

Participation

You must be 18 years or older to participate in this interview.

There are no right or wrong answers. Please answer the questions as honestly as possible. Participation is completely voluntary. You may withdraw your participation at any time for any reason, without penalty.

If these questions become too mentally taxing at any time and you feel that you need additional help, please do not hesitate to contact the UNCP Student Health Services (shs@uncp.edu 910-521-6219) or the UNCP Counseling and Psychological Service (910-521-6786) for their services.

Confidentiality

Your information will not be shared at any time; results will only be reported in an aggregate form. Any names and emails used for contact purposes will be kept confidential. This

information will not be reported in the final analysis, nor will it be connected to previous survey results.

The interview will take place over WebEx. The interview session will be recorded and transcribed only for data analysis purposes by the principal investigator. You will be provided a copy of this transcript by email and will have one week to make any amendments you see fit before the data is analyzed. Nobody else will have access to this information and it will be destroyed after the study is complete.

Benefits

There are no direct benefits to you as a participant in this research study; however, this research will contribute to the knowledge of the factors that affect bioethical decisions and hopefully provoke further research in this area. This information along with further research could eventually be used to customize bioethics education training for both students and professors in the form of a course or workshops. This research will encourage bioethics education and thus help students become more bioethically informed in the future.

Risks

There are no risks to the participants greater than what is experienced in everyday life. Risk is limited to breach of confidentiality. Steps will be taken to prevent this by using pseudonyms in the final analysis. Names and emails will not be connected to any results in the study and will only be used for contact purposes only; this information will be destroyed after all necessary contact is complete. Transcripts will also be destroyed after data analysis.

You may contact the principal investigator at any time with questions or concerns.

Thank you for your participation!

I have read the information provided above. I have asked all the questions I have at this time. I confirm I am 18 years or older. I voluntarily agree to participate in this research study interview and am aware it will be recorded for data analysis purposes only.

I consent to participate in this interview. Yes_____ No_____

I agree to be recorded for this interview. Yes_____ No_____

Signature of Participant:

Date:

Appendix J- Interview Questions

General Protocol:

Thank you for agreeing to participate in this online WebEx interview about bioethics. My name is Ashley Lytle and I will be conducting the interview and by asking you a few questions, of which some were on the Bioethics survey you took online recently. This survey will be recorded for research purposes only so is that okay with you? Later I will listen to this interview again so that I can review your answers as a part of my research. I am happy to provide you with the recording of this interview as well if you would like me to. This interview is completely anonymous and your name will never be used when sharing what you have told me here. After I am finished with my thesis, all of the data, including this interview and the recording will be destroyed. This interview should take approximately 30 minutes of your time. Do you have any questions? Are you ready to begin now?

Questions:

1. Can you tell me a little bit about yourself? What are your STEM interests, if any?

2. Describe to me what you think bioethics is exactly?

3. Do you remember this question from your survey? How did you answer this question?

Q6: How acceptable do you think the following statements are?

	Completely Acceptable	Somewhat Acceptable	Neither Acceptable nor Unacceptable	Somewhat Unacceptable	Completely Unacceptable
Would chicken made less fatty through biotechnology be acceptable or unacceptable if genes were added to the chicken from another type of animal?	○	○	○	○	○
Would such chicken be acceptable or unacceptable if the genes came from a human?	○	○	○	○	○

Can you tell me a little bit more about your answer here? What might be your reasons? Can you give me an example?

4. Do you remember this question from your survey? How did you answer this question?

Q12: How do you feel about scientists changing the genetic makeup of human cells to:

	Strongly Approve	Somewhat Approve	Neutral	Somewhat Disapprove	Strongly Disapprove
a. Cure a usually fatal disease, such as cancer	○	○	○	○	○
b. Reduce the risk of developing a fatal disease later in life	○	○	○	○	○

Can you tell me a little bit more about your answer here? What might be your reasons? Can you give me an example?

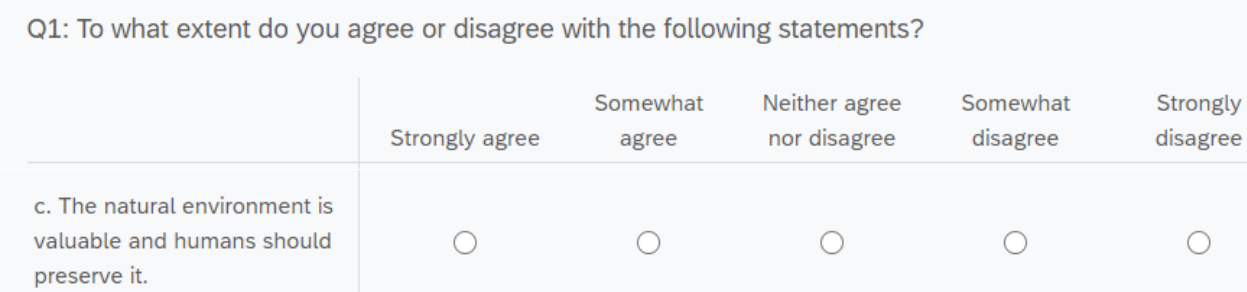
5. Do you remember this question from your survey? How did you answer this question?

Q19: If someone is a carrier of a defective gene or has a genetic disease, who else besides that person deserves to know that information?

	Yes	No	× Don't Know
a. Employer	○	○	○
b. Insurer	○	○	○
c. Spouse or fiancé	○	○	○
d. Other immediate family	○	○	○
e. Government Health Organization	○	○	○

Can you tell me a little bit more about your answer here? What might be your reasons? Can you give me an example?

6. Do you remember this question from your survey? How did you answer this question?



Q1: To what extent do you agree or disagree with the following statements?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
c. The natural environment is valuable and humans should preserve it.	○	○	○	○	○

Can you tell me a little bit more about your answer here? What might be your reasons? Can you give me an example?

Is there anything else you would like to tell me about bioethics and do you have any other questions?